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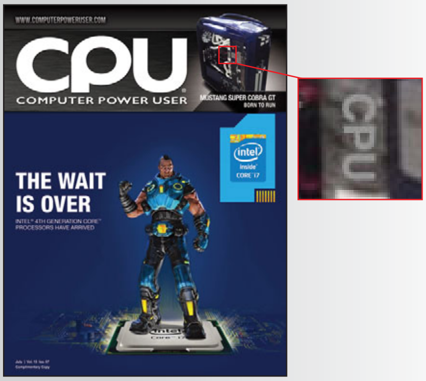
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Elgato Takes Its Game-Capture Act Live

Elgato, maker of the Game Capture HD ($179.95), recently announced that its device became the first to support YouTube's new Live Streaming API. As such, gamers who possess a streaming-enabled YouTube account can broadcast gameplay from any game from straight within the Game Capture HD's included software, the company states. Further, with one click gamers can launch the live broadcast complete with audio commentary using their headset's microphone while simultaneously capturing the stream. The Game Capture HD also makes it possible to edit gameplay footage and share recorded action via numerous social networks. Overall, the Game Capture HD records Xbox 360- or PlayStation 3-based action in 1080p using H.264 hardware encoding. The device connects directly to a console and provides output to a TV via HDMI pass-through. Among the Game Capture HD's cooler features is Flashback Recording, a time-shifting tool that lets you go back to a scene's beginning and record retroactively.

SSDs Poised For Rosy Near-Term Growth

The near future for SSD storage appears exceedingly bright, according to projections that IHS iSuppli announced in early May. Specifically, the research firm expects SSD-based storage to make up roughly one-third of all PC-based storage by 2017. The report says that in 2012, shipments of SSD drives totaled just 31 million. By 2017, however, that number is expected to explode to 227 million drives. What we will have to thank for that growth? IHS iSuppli reports that the "expected increase in popularity of ultrabooks and other ultra-thin notebooks" just now starting to blossom will be directly responsible. By way of comparison, hard disk drive shipments totaled about 475 million in 2012 and are projected to dip to roughly 410 million in 2017. If all the numbers hold true, the change in storage fortunes would give SSDs a 36% stake of the overall storage market and HDDs 64% by 2017. Presently, SSDs possess just a 6% market share.

WATCHING THE CHIPS FALL

Here is the pricing information for various AMD and Intel CPUs.

CPU	Released	Original Price	Last Month's Price	Online Retail Price*
AMD FX-8350 Eight-Core	10/23/2012	$195	$189.99	$199.99
AMD FX-8320 Eight-Core	10/23/2012	$169	$174.99	$174.99
AMD FX-8150 Black Edition Eight-Core	10/12/2011	$245**	$179.99	$179.99
AMD FX-8120 Black Edition Eight-Core	10/12/2011	$205**	$159.99	$159.99
AMD FX-6100 Black Edition Six-Core	10/12/2011	$165**	$119.99	$119.99
AMD A8-3870K Black Edition Quad-Core	12/20/2011	$135**	$89.99	$86.99
AMD A8-3850 Quad-Core	7/3/2011	$135**	$89.99	$84.99
AMD FX-4100 Quad-core	10/12/2011	$115**	$104.99	$99.99
AMD A10-5800K Quad-Core	10/12/2012	$122	$129.99	$129.99
AMD A6-3650 Quad-Core	7/3/2011	$115**	$74.99	$69.99
Intel Core i7-3970X Extreme Edition	11/12/2012	$999**	$1,029.99	$1,029.99
Intel Core i7-3960X Extreme Edition	11/14/2011	$990**	$1,069.99	$1,069.99
Intel Core i7-3930K	11/14/2011	$555**	$569.99	$569.99
Intel Core i7-3770K	4/23/2011	$332**	$329.99	$329.99
Intel Core i7-3770	4/23/2011	$294**	$289.99	$289.99
Intel Core i7-3820	2/12/2012	$305**	$299.99	$299.99
Intel Core i5-3570K	4/23/2011	$225**	$219.99	$224.99
Intel Core i3-3240	9/2/2012	$147	$149.99	$149.99
Intel Core i3-2130	9/4/2011	$138**	$129.99	$129.99
Intel Core i3-2120	2/20/2011	$138**	$124.99	$129.99

* As of June 2013
** Manufacturer's estimated price per 1,000

AOC Unveils Ultrawide, Cinematic Eye-Candy

If you're one to mix business with pleasure, consider plopping AOC's new sprawling 29-inch cinematic, ultrawide Q2963PM LED monitor ($499) on your desktop. The company claims that "work and leisure won't be the same." Touting a WFHD (2,560 x 1,080) resolution, IPS LED technology for boosting image quality, a 21:9 aspect ratio and a 50 million:1 dynamic contrast ratio, dual 3W speakers, and 178-degree vertical and horizontal viewing angles, the Q2963PM also provides nifty picture-by-picture and picture-in-picture abilities. Both modes enable viewers to simultaneously bask in visuals coming from separate sources. The Q2963PM also supports daisy-chaining multiple monitors to form one huge screen or many individual ones. Screen+ technology, meanwhile, enables dividing the screen into separate zones, while MHL support lets you connect an Android smartphone or tablet directly to the monitor while it charges.

Lenovo Gives Tabletop PCs A New Feel

Perhaps you're familiar with Lenovo's 27-inch IdeaCentre Horizon Table PC (starts at $1,699.99), a multi-talented "interpersonal" system that functions as a standard Windows 8 PC in upright position but also horizontally on tabletops, in which position Lenovo's Aura interface kicks in to enable four-player simultaneous gameplay. To bolster the idea that the Horizon offers a different type of home PC experience than usual, Lenovo recently unveiled three furniture concepts at the International Contemporary Furniture Fair. The designs include "The Treehouse," which "creates a magical world of whimsy" suitable for kids, and "The Nest," which takes the nesting table form factor in a different direction by integrating the Horizon into a table-like structure that includes hidden chairs and storage space to house the Horizon's PSU, keyboard, and included physical game pieces. Last but not least is the "AT-UM," a central hub design suitable for studio- and café-like spaces that aimed at fueling "creative projects and interests with a digital twist."

The Triple-Threat Python S3 Tablet

On one hand, you could look at Italian-based Ekoore's decision to support Android, Windows, and Linux OSes with its new Python S3 tablet as overkill. On the other hand, you could say Ekoore is just covering all the bases. Packing an Intel dual-core 847 processor, 8GB RAM, options for up to 128GB storage, and an 11.6-inch screen (1,366 x 768), the Python S3's ability to boot Android 4.2, Windows 8, or Ubuntu 13.04 makes it "the most complete tablet that has ever existed," Ekoore proclaims on its website (courtesy of Google Translate). Add all the tablet's features up and Ekoore says that users can expect the ability to use "heavier software" developed for Windows and Linux. The Python S3 starts at $770 (Wi-Fi and 3G available), but for another $179, buyers can score a keyboard dock accessory that serves as a second battery source and adds a touchpad, function keys, two USB ports, and an Ethernet port.

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"Every Phone Can Be A Laptop"

As Livi Design sees it, no smartphone maker has "had the courage to make an accessory that doesn't lock its customers into buying their specific products forever for support and additional income." The company's upcoming Casetop looks to change this by supporting any smartphone possessing Bluetooth and video-out abilities "for a minimum of 10 years" via use of HDMI, MHL, and Micro-USB connections. Upon connecting to a smartphone via Bluetooth, the netbook-sized Casetop provides an 11.1-inch 720p glass-cover LCD display and full-sized 78-key keyboard that make productivity chores a far friendlier endeavor than if done on a smartphone. Because the Casetop doesn't contain its own CPU, RAM, or motherboard, files never leave the user's phone; this makes sharing the Casetop as simple as disconnecting one user's phone and connecting another. The Casetop does integrate a 56 watt-hour battery pack that provides 30-plus hours of battery life and charges the smartphone docked in the Casetop's Frontbar. Two 1W speakers; a 3.5mm audio jack; and HDMI, MHL, Micro-USB, and USB ports are also built in.

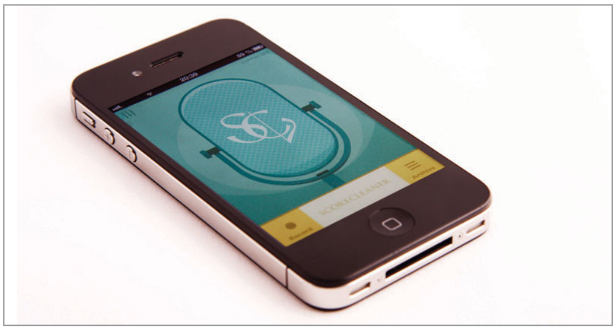
HARDWARE MOLE

Staples Plugs Into 3D Printers

Getting your mitts on your very own 3D printer is about to get a whole easier thanks to a deal that Staples and 3D Systems recently announced. Starting in June, Staples will start selling the Cube 3D Printer from 3D Systems in a limited number of retail outlets. The printer is already available online via Staples for $1,299.99. 3D printers in general have been inching ever closer to reaching the "all the rage" mark of late, but the Staples-3D Systems partnership may considerably accelerate the journey. That's due partially to the Cube 3D's many consumer-friendly features vs. some other 3D printer options. Such options include Wi-Fi support, 25 3D templates included free, and the fact that the printer comes ready to use upon unpacking. Printing-wise, the Cube 3D can create 5.5 x 5.5 x 5.5-inch prints in 16 colors using the templates or a user's own design as created in 3D Systems' Cubify Invent software.

Das Keyboard Shushes The Mechanical Keyboard

The Das Keyboard Professional has garnered favorable comparisons to IBM's legendary Model M keyboard for its tactile feel, solid construction, and the audible feedback its keys provide. Turns out, however, not everyone is so keen on those "clicks" and "clacks" its keys produce. To that end, Das Keyboard has released the Model S Professional ($149) with Quiet Key Design. Billed as being "whisper quiet," the board still offers Cherry MX Red key switches, but whereas most boards require 55 to 60g of force to actuate keys, the Model S Professional requires just 45g. The glossy black keyboard is short on aesthetic attention grabbers but is beyond sturdy at 3 pounds, integrates two USB ports and media controls, and provides an included PS/2 adapter for full n-key rollover support (six-key support via USB connection).

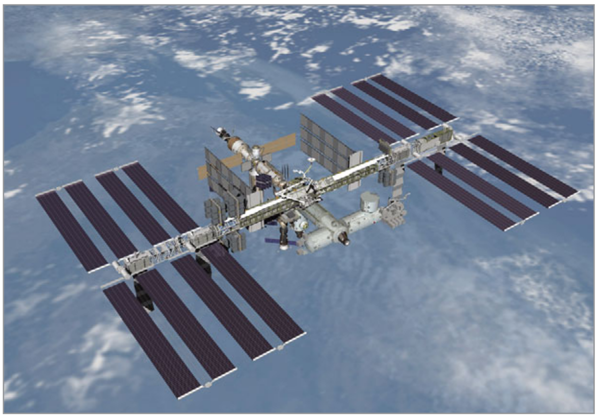


ScoreCleaner Writes The Songs You Sing

Ever composed what you believed was a hit in your head but couldn't put it to paper because you lack music writing/reading knowledge? ScoreCleaner Notes could have helped. The 99-cent app listens to a melody (monochromatic only) you sing, whistle, or hum (no instruments needed) and immediately displays it in musical notation in the right key, tempo, and time signature. The app comes from Sven Emtell and Sven Ahlbäck, who have ties to the KTH Royal Institute of Technology and KMH Royal College of Music, respectively. Their creation enables sharing results via social networks or email. Users can edit their works via a Desktop version and store them in available ScoreCleaner Cloud space. Emtell says the aim is to revolutionize the music industry, and the app "is revolutionary because it has the potential to unleash the creativity of musicians and music teachers worldwide." The app's ability to listen to and comprehend musical structure is based on research focused on how people interpret music.

International Space Station Welcomes Linux Aboard

Windows XP is out. Linux is in. That's the situation now for the computers running on the International Space Station following a recent switch by the United Space Alliance, which NASA contracts to manage the ISS' computers. "We migrated key functions from Windows to Linux because we needed an operating system that was stable and reliable—one that would give us in-house control," says Keith Chuvala, leader of the United Space Alliance's Laptops and Network Integration Teams. "So if we needed to patch, adjust, or adapt, we could." The recently migrated laptops now run Debian 6 and belong to the OpsLAN, a network of systems the ISS crew uses to execute daily operations. The Linux Foundation trained United Space Alliance staff via two specifically customized courses ("Linux for Developers" and "Developing Applications for Linux") to help meet the staff's needs.



SOFTWARE SHORTS

Samsung Wants Your Apps

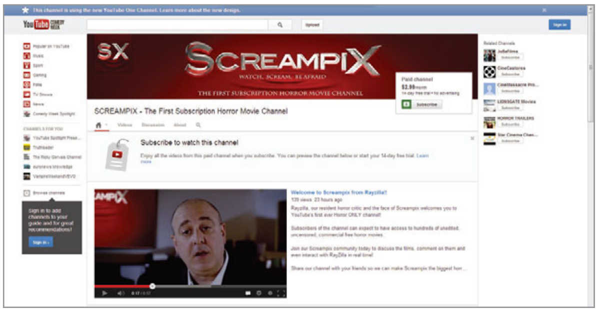
One way to get mobile app developers to create apps for your devices is to entice them with money. That's exactly what Samsung is doing with the Samsung Smart App Challenge 2013, a contest that will award $800,000 in prize money to 10 winners and that will enable Samsung to "greatly enhance application choices" for its Galaxy S4 smartphone. Participants must use the Samsung Chord SDK, which enables Group Play connections so multiple users can share media, collaborate, play games, and more. Developers have from June 20 to Aug. 31 to submit entries, which must be sold in the Samsung Apps marketplace and use Samsung APIs for in-app purchases. Judging will take place through November, and Samsung will name winners in December with the best app earning its developer $200,000 and consideration for venture investment from Samsung, as well as various marketing perks.

Backup Generator For The Internet

That's the idea behind BRCK, a device that Ushahidi, a non-profit, Nairobi, Kenya-based company, is bringing to life to provide "the easiest, most reliable way to connect to the Internet anywhere in the world, even when you don't have electricity." Ushahidi was well on its way at press time to successfully completing a Kickstarter campaign to help fund the BRCK, which can run on electricity or battery power (8 hours) if electricity goes down, switch among networks, and create a mobile hotspot supporting up to 20 devices. Ushahidi (Swahili for "testimony") says the BRCK works similar to a cell phone, "intelligently and seamlessly switching between Ethernet, Wi-Fi, and 3G or 4G." Plug in a SIM card or establish a wired/wireless connection and the device automatically goes online. BRCK Cloud, meanwhile, provides a website users can access anywhere to verify network connections, electricity performance, and more. The first BRCK units are expected for a November release with more to come in spring 2014.

YouTube Presses Play On Paid Subscription Channels

Digital subscriptions to newspapers, magazines, and music and video services have been around long enough that most of us take them for granted at this point. As such, it may seem odd to some that YouTube, the online video service that made online video a thing, is just now offering subscriptions. Better late than never, though, and in early May, Google unveiled a pilot plan for a select group of partners to offer paid channels via subs starting at 99 cents a month. A 14-day free trial comes with each channel, and many channels offer a discount for upgrading to an annual subscription. Once subscribed, users can view videos from multiple devices. The YouTube team promises more paid channels will be coming by way of a self-service feature available to qualifying partners. Among the channels now available is Screampix, billed as "YouTube's first ever Horror Only channel." On tap for $2.99 per month are the likes of "When Puppets & Dolls Attack," "Secrets of the Clown," and "Gingerdead Man 2."



SCREAMPIX - The First Subscription Horror Movie Channel

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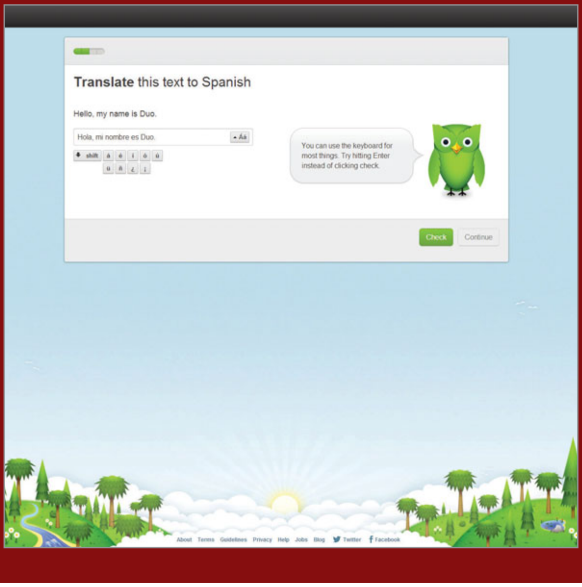

Translate this text to Spanish

Hello, my name is Duo.

Hola, mi nombre es Duo.

You can use the keyboard for most things. Try hitting Enter instead of clicking check.

Duolingo.com Teaches & Translates

How effective is Duolingo.com, a website that offers free language-learning tools for Spanish, English, French, German, Portuguese, and Italian? According to an eight-week study commissioned by Duolingo.com and conducted by researchers from Queens College City University and the University of South Carolina, participants with no knowledge of Spanish would require an estimated 26 to 49 hours (34 hours on average) to cover a first semester's worth of collage Spanish spanning 11 weeks. Because a university course "usually takes more than 34 hours of work," the researchers reason, "the study suggests that Duolingo is more effective than university." Duolingo.com can teach users ad-free and at no cost because as they're learning they're also creating translations of real-world documents various third parties commission. Duolingo.com says that if 1 million users used Duolingo, "the entirety of English Wikipedia could be translated to Spanish in just 80 hours."

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Decade(s) Late, Dollar(s) Short

The younger you are, the more likely you are to be an Internet-savvy, website-hopping guru, right? That may be the case, but the older you are, the more money you’re likely to spend online. Here’s how much members of each generation spend online every month, on average, according to Forrester Research:

Boomers: $650
Gen X: $581
GenY: $429

Tablets To The West Of Me, Phones To The East, Here I Am

The number of people accessing the Internet primarily by mobile devices is steadily increasing. The type of device people are more likely to use – phone or tablet – appears to be linked somewhat to their geographic area. Tablets are preferred over smartphones in North America and Europe, while people in the Far East and down under favor their phones.

Mobile Internet Usage By Country (As % Of All Net Users)

	Tablet	Smartphone
U.K.	12.2	7.4
U.S.	9.1	7.4
Canada	8.7	6.8
Australia	7.7	7.8
Japan	7.4	9.2
France	6.1	3.5
Germany	5.7	4.3
China	3.1	5.9

(Adobe Digital Index, April 2013 via Center For Media Research)

RAW Numbers:

1

Number of American jobs created for every 33 trips that overseas travelers make to the United States.

(U.S. Travel Association)

$28,427

The average amount spent on a wedding in the U.S. during 2012.

(TheKnot.com)

509,000

The number of websites out of the top 1 million largest sites that use a “.com” domain.

(Pingdom.com)

10 billion

Number of devices that are curently able to wirelessly connect to the so-called “Internet of Everything.”

(ABIResearch)

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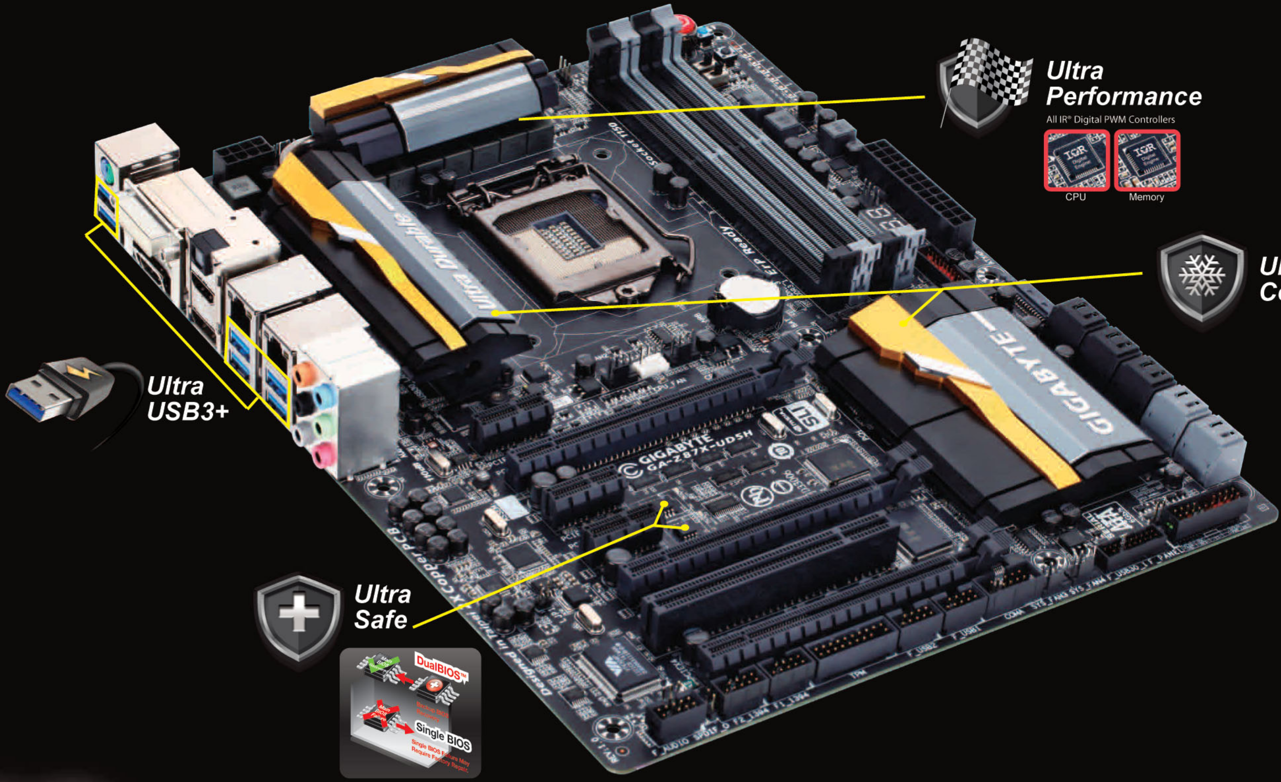

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Intel 4th Generation Core Processors

Something Epic Has Arrived

The word "epic" tends to be a tad overused these days, but in the case of Intel's new 4th Generation Core Processors, it might be an apt descriptor. After all, what would you call a chip that is noticeably faster at everything than the world's previous performance champ and that still manages to be even more energy efficient?

"With every iteration of new Intel processors, we continually see improvements in power efficiency and overclocking capabilities," says Eddie Vong, head of R&D for gaming PC powerhouse CyberPowerPC. "The 4th Generation Core Processors continue this tradition with astounding overclocking headroom coupled with lower operational voltages."

iBuyPower Marketing Manager Ricky Lee agrees. "In general, we've observed an increase in compute performance across the board, when compared clock-for-clock against the previous generation. Video conversion performance benefits hugely from Quick Sync; the performance gain is pretty phenomenal."

Intel Technical Marketing Engineer Darrin Lynch has more to say about improvements to Quick Sync: "The performance increase is up to 50% on some applications, and if you used it before you know what kind of speed that is," he says.

& That's Not All . . . .

In addition to video performance increases, games and other applications run faster on 4th Generation Core Processors, as well.

"There are increases everywhere, but the real advantages are in the multi-core applications," Lynch says. "Each of our cores is faster than the previous generation, so when

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you tell the CPU to use four cores or four cores and four additional threads, you see tremendous overall performance increases."

Vong says CyberPowerPC has seen these increases in its benchmarking comparisons. "We've observed anywhere from a 10 to 20% increase on the majority of our benchmark suites using Intel's new 4th Generation Core Processors. From 3DMark Vantage to 3DMark 11, PCMark, and a variety of gaming titles we routinely FPS-test and benchmark."

The best part is that these performance increases will provide meaningful benefits to everyone, from early adopters and hardcore gamers to content creators and casual users.

Of course, as nice as higher performance is, it's only the beginning of the story.

More Power . . . & Less

In most cases, power and efficiency are a trade-off; you have to give up one to get the other. That's not the case with Intel's 4th Generation Core Processors, however. The 22-nanometer manufacturing process they share with the previous generation is highly efficient, of course, but Intel didn't stop there.

"We have further refined features we had in previous generations, such as the ability to completely turn off cores vs. putting them in a deep sleep—off is better than sleeping when it comes to power savings," Lynch says. However, one of the biggest architecture changes is the fully integrated voltage regulators. We pulled the voltage regulators for each individual CPU power rail off the motherboard and put them into the CPU. This allows the CPU tremendous control over the power coming into it."

Redefining Processor Graphics

The benefits of Intel's 4th Generation Core Processors' compute performance and power savings are pretty clear, but Intel is also proud of the impressive leaps it has made with its HD Graphics technology.

"For most users, the largest single performance increase will be with the new HD Graphics," Lynch says. "While this is not a hardcore gaming graphics solution, it is definitely equal to the task of most games and any of your video playback requirements."

"Intel's HD Graphics technology has continually improved with each generation of CPUs, dating back to Lynnfield and the P55 chipset," says Vong. "With the latest HD 4000 series graphics in Haswell CPUs, we're seeing it as a strong competitor to some of the entry-level graphics from NVIDIA and AMD, which is a remarkable improvement in just a few years."

The Total Package

When combined with an 8-series chipset-equipped motherboard, Intel's 4th Generation Core Processors represent the best total computing solution on the market today, for a wide variety of users.

"We have made improvements across the entire platform," Lynch says, "from USB 3.0 and SATA 6Gbps ports on the chipset to exciting new features inside the CPU."

All of this, and suggested retail pricing in line with 3rd Generation Core Processors at their launch? Epic, indeed. ■

Here Comes The Boom

These Headsets Are Ready To Make Some Noise

We all know that there's more to our beloved games than just the pretty graphics. In this roundup, we're giving the audio aspect its day in the sun by trying on a handful of gaming headsets from some of the biggest names in PC hardware, including Cooler Master, Corsair, Creative Labs, GIGABYTE, Logitech, Thermaltake, and Rosewill.

To get a feel for how each headset performs, we tested the frequency range with a variety of music, evaluated 3D surround capabilities (for those that offer true or virtual surround sound) with a handful of games, and wore the headphones for a couple of hours each to determine the comfort level throughout an extended gaming session. If you're in the market for a new gaming headset, consider this your shortlist.

Thermaltake Tt eSPORTS DRACCO Captain

Thermaltake's DRACCO Captain stereo headset differs in a number of ways from the Shock and Shock Spin headsets we've tested in the past. The DRACCO Captain was designed in cooperation with e-sports legend Aleksey "White-Ra" Krupnyk. The visual style is rather muted compared to some of Thermaltake's other headsets and headphones. It features a black rubberized finish on the cans, boom mic, and headband joints. The ear pads and top of the headband are also black, and touches of red can be found around each can, at the joints, in the dragon logo, and on the headband.

Although they're all stereo headsets, the older Shock models feature an adjustable bi-plane headband, whereas the DRACCO Captain opts for mesh-covered foam against your scalp and textured faux leather up top. The headset uses a detachable, gold-plated, 3.5mm analog jack for its connector. When you're ready to head to the LAN party, you can fold the headset up and store it in the included cloth bag. Overall, the unit is fairly light, which helps make for a comfortable wearing experience even hours into a heated gaming session. The padding on the cans is also designed to surround your ear and rest against your head, rather than on top of your ear, which adds a few points in the comfort column.

The DRACCO Captain is designed to be a studio-quality gaming headset that hopes to win your ears over with the sheer force of its 50mm neodymium magnet drivers with an impressively wide 10Hz to 22kHz frequency response. In our listening sessions, the DRACCO Captain

Specs: Drivers: 50mm, 10Hz to 22kHz; Mic: 100Hz to 10kHz; In-line controller: Yes; Connector: Analog 3.5mm plug

Tt eSPORTS DRACCO Captain
$89.99 | Thermaltake | usa.ttesports.com

When the unit's fully charged, you get 16 hours of continuous wireless gaming, and your tether is much longer; we walked about 50 feet away from the receiver before we noticed a hiccup in the signal.

sounded great no matter what source we fed through its braided cables. Bass was effectively deep, mids felt full of nuance, and the highs were vibrant.

We also like the unit's braided cables, which tend to be more durable and resist tangling more than unbraided cables. The unit also has an in-line volume control with a mute switch and clip. The omnidirectional microphone is not detachable, but you'll appreciate its ability to rotate approximately 300 degrees, letting you put it well out of the way when not in use. Because this headset utilizes an analog 3.5mm jack instead of the driver-dependent USB models in this roundup, you can use the headset with an MP3 player, tablet, portable DVD player, or any other device with a standard 3.5mm output jack.

It's hard to strike a balance between a lightweight design and powerful drivers, but Thermaltake seems to have found the perfect recipe in the DRACCO Captain.

Specs: Drivers: Front/rear/center 30mm each (10Hz to 20kHz), subwoofer 40mm; Mic: 100Hz to 10kHz; In-line controller: Yes; Connector: USB

CM Storm Sirus S
$99.99 | Cooler Master | www.coolermaster-usa.com

Cooler Master CM Storm Sirus S

According to Cooler Master, this headset was built for gaming enthusiasts and audiophiles, which means it's capable of fully immersing you in your media, no matter what you're listening to. But the Storm Sirus S' real advantage should be obvious to gamers—after all, it helps to know where that sniper's shooting from before he takes a second shot. The CM Storm Sirus S can do that thanks to the eight discrete speaker channels (four per can) that deliver accurate positional audio for a more immersive experience in movies and games. The front, center, and rear drivers are all 30mm each, but the impressive bass tones are produced via a pair of 40mm drivers.

The headset has a flat black appearance and a rubberized finish that so many of Cooler Master's products feature. The red CM Storm logos on the sides of the cans are also backlit. Braided cabling is a nice extra, and you'll also appreciate that this headset comes with interchangeable ear cushions, one that's a breathable microweave fabric and another that's covered in noise-cancelling leatherette. The unidirectional boom mic features noise-cancelling technology to block unwanted background noise. Another feature we like is the in-line volume control with a mute button and separate center and sub channel volume controls.

With the Tactical Mixing Console, Cooler Master puts the power in your hands; you can select rear, front, master, center, and bass channels to adjust them on the fly. The headset backs up its good looks with plenty of brains, a combination that's hard to deny.

Creative Labs Sound Blaster Tactic3D Rage Wireless

Creative Labs' Tactic3D Rage gaming headset has the full weight of the firm's audio expertise behind it. This unit uses an uncompressed 2.4GHz ISM band to wirelessly transmit gaming, music, and other audio sources from the USB dongle plugged into your PC to the headset. It comes with a braided USB cable that lets you recharge the unit without interrupting your listening session, though the cable is only about 3 feet long. When the unit's fully charged, you get 16 hours of continuous wireless gaming, and your tether is much longer; we walked about 50 feet away from the receiver before we noticed a hiccup in the signal. There's also nary a trace of the faint buzzing common with subpar wireless headsets.

The unit is all black except for a handful of red plastic accents. Each can also has a dark acrylic window backlit with a color-shifting LED. After you download and install the headset software (it's not bundled with the headset), you get access to the SB Prism LED illumination, which lets you select one of 16 million colors and configure the pulse rate. The software also includes EQ settings, voice morphing, and SBX Pro Studio extras, which lets you fiddle with knobs such as Crystalizer, Surround, Bass, Dialog Plus, and Smart Volume. As its

Specs: Drivers: 50mm, 20Hz to 20kHz; Mic: 100Hz to 6.5kHz; In-line controller: On can; Connector: Wireless (2.4GHz), USB; 16-hour battery life

Sound Blaster Tactic3D Rage Wireless
$99.99 | Creative Labs | us.creative.com

Those virtual 5.1 and 7.1 surround headsets sound good, but your ears can tell the difference between a simulated sound field and an actual one, like the RHTS-8206 and Cooler Master's Sirus S deliver.

GIGABYTE FLY

We interrupt this headset roundup to bring you a brief look at the GIGABYTE FLY headphones. Your gaming headset is by no means going to be your only head-mounted audio apparatus. For those times when you'd like a pair of headphones that are compact enough to go with you wherever you go, but aurally capable enough to make listening a worthwhile experience, then look to the GIGABYTE FLY. This unique set of headphones combines the sound quality you get from a large driver, in this case a pair of 40mm drivers with a frequency response of 15Hz to 20kHz, with a very lightweight headband and a portable form factor.

The sound produced by the Fly is solid. The highs, mids, and lows are all well-defined, especially compared to the bundled earbuds and headphones that you may be used to. The drivers are wrapped in silver metallic cans topped with a soft pad that rests against your ear, making long listening sessions not only sonically impressive but also comfortable. The 3.5mm analog jack lets you listen to numerous sources by simply plugging it in. The simple curved metal headband is adjustable; there's about an inch of extra headband length tucked in each of the cans. The brushed aluminum look with the blue accents is also striking to behold.

If you're looking for a pair of headphones that are significantly more powerful than your earbuds, but significantly more portable than the headsets in this roundup, the GIGABYTE Fly is the perfect middle ground. ■

FLY
$49.99 | GIGABYTE | www.gigabyte.us

Specs: Drivers: 40mm, 15Hz to 20kHz; Mic: None; In-line controller: None; Connector: Analog 3.5mm plug

name suggests, this headset is also capable of simulating a set of surround sound speakers strapped to your head.

The headband and cans are both padded with memory foam and covered with faux leather. Despite the large drivers, the headset is fairly light overall, and it was plenty comfortable during an extended gaming session. For those who wear glasses, however, the cans rest on your ears, which can become painful as the temple tips are pressed against your head.

The 50mm neodymium magnet FullSpectrum drivers in this headset deliver full bass, detailed highs, and an impressively expressive midrange. The flexible mic is detachable, but you can also angle it out of your line of sight if necessary. Another feature we like is the on-headset volume wheel and mute button.

The Sound Blaster Tactic3D Rage is a solid headset for gaming and listening to multi-channel sources. It also has a number of cool features for which you'd expect to pay much more.

Rosewill RHTS-8206

Rosewill is known for everything from cases to keyboards, but today we're taking a look at the company's RHTS-8206, a USB-based headset that contains three discrete drivers and a sub in each can. As a result, the Rosewill RHTS-8206 is capable of delivering real 5.1 surround sound capabilities and virtual 7.1 surround sound in movies and games that support it. The 40mm Nd-Fe-B magnetic drivers generate a more vivid surround sound field than purely virtual surround units can accomplish.

Although the extra drivers don't add much to the stereo sources we listened to, this headset does handle 5.1-channel content with amazing accuracy. Those virtual 5.1 and 7.1 surround headsets sound good, but your ears can tell the difference between a simulated sound field and an actual one, like the RHTS-8206 and Cooler Master's Sirus S deliver.

The cans feature large, soft ear pads that seal external sounds out while remaining comfortable for extended periods. The

Specs: Drivers: center (20Hz to 20kHz), front (20Hz to 20kHz), surround (20 to 20kHz), subwoofer (30Hz to 150Hz); Mic: 30Hz to 16kHz; In-line controller: Yes; Connector: USB

RHTS-8206
$59.99 | Rosewill | www.rosewill.com

flexible mic boom has about 70 degrees of rotation, so you can push it up and out of the way when you're not using it. You can also pull the noise-cancelling mic from the 3.5mm jack to remove it completely.

As we've mentioned, we're fond of in-line volume controls, but Rosewill adds a little extra to the formula—mic, mute, headphone mute, and volume up/down buttons. It also has a Vibe slider, which switches between two levels of vibration for more visceral bass performance. If you're taking this headset on the road, you'll be happy to know that the cans fold flat for easy stowage.

As one of the more affordable headsets in this roundup, Rosewill's RHTS-8206 has a number of extras gamers won't want to miss.

Corsair Vengeance 2000

The Corsair Vengeance 2000 has an over-the-head design with large cans that completely cover the ears. It includes a flexible adjustable boom mic and a unique volume barrel on the left earcup. The headband is padded and covered with faux leather, and the earcups too are padded and covered with soft felt. The cushions themselves feature memory foam, and although the difference between it and the foam ear cushions on many of the other headsets here isn't immediately apparent, you'll notice how comfortable the Vengeance 2000 remains even after a couple hours of gaming, listening to music, or watching video.

Under that soft padding and a thin layer of blue fabric are two large 50mm drivers, each with a frequency response of 20Hz to 20kHz. This headset performed admirably with the stereo sources we listened to, reproducing crisp highs, full mids, and thick and heavy lows. Corsair recently updated the Vengeance 2000's driver to support Dolby Headphone 2.0 and Dolby Pro Logic IIx. The former technology delivers up to 7.1-channel surround sound, and the latter upconverts stereo and 5.1 channel sources to 6.1 or 7.1 output.

The Vengeance 2000 has an effective wireless range of up to 40 feet and a USB charging cable that lets you go wired if the integrated rechargeable battery runs out. That's not likely to happen very often, however; the Vengeance 2000 has a 10-hour battery life.

The unidirectional noise-cancelling microphone rotates up and out of the way when you aren't using it and back down approximately 120 degrees when you want to communicate in games, VoIP calls, or chat sessions. You can also adjust the angle of the mic at the end of the boom. The mic has a 100Hz to 10kHz frequency response and a -37dB (+/- 3dB) sensitivity, so you come across loud and clear to whomever you're speaking with.

Overall, this headset was easily one of the more comfortable ones to wear for long periods. The large drivers handle stereo and surround sound sources exceptionally well. We also like the brushed aluminum look of the headset, which is composed entirely of plastic. We were also surprised with how light the unit is. If you're shopping for a new headset, then Corsair's Vengeance 2000 is a solid buy.

Logitech G930

Logitech makes some great gaming gear, so it's no surprise that the G930 has a number of bells and whistles for your ears. This headset uses a 2.4GHz connection to stream 48kHz audio between the charging base and the headset, and you'll have to hear it to believe the resulting crystal clear audio. The wireless range is also impressive, up to 40 feet according to Logitech, which we verified in an office with numerous Wi-Fi

Specs: Drivers: 50mm, 20Hz to 20kHz; Mic: 100Hz to 10 kHz; In-line controller: On can; Connector: wireless/USB; 10-hour battery life

Vengeance 2000
$149.99 | Corsair | www.corsair.com

Specs: Drivers: 40mm, 20Hz to 20kHz; Mic: 100Hz to 75kHz; In-line controller: on can; Connector: Wireless (2.4GHz), USB

G930
$149.99 | Logitech | www.logitech.com

networks and other 2.4GHz wireless devices to interfere.

This headset uses a pair of 40mm neodymium magnet drivers (20Hz to 20kHz). Aside from offering a static-free wireless listening experience, this headset also accurately reproduces sound in games, music, and movies, with ear-pleasing lows, mids, and highs. And thanks to second generation Dolby Headphone technology, you can game and watch movies in virtual 7.1 surround sound.

The flexible mic boom angles up and out of the way when not needed, and in this position the mic auto-mutes. (An unobtrusive red LED indicates when the mic is muted.) The headset is extremely light and it helps that there aren't any wires hanging from one side, comfort was on par with the best in this roundup. The unit has an internal rechargeable battery that offers up to ten hours of listening time, but you can still use it while charging from the USB charging base (albeit with the charging cable hanging from one side of the headset).

We also like the on-ear volume control and the programmable G-keys. The voice-morphing software was fun to play with, but you may annoy your friends if you leave it enabled for a long gaming session. Although it's one of the more expensive headsets you can buy, the extras make this one of the more comfortable, portable, and best sounding headsets.

Awesome Audio

Anyone in the market for a new gaming headset is sure to find something worthwhile in this group, whether they have meager budget, aren't wild about wires, demand discrete speakers for their surround sound experience, or prefer a single full-range driver in each can. No matter what you're looking for, each of these headsets is comfortable to wear and is capable of filling the space between your ears with gunshots, squealing tires, soaring scores, and crisp dialog. Now you just need to figure out how to combat the inevitable headset hair you get after a protracted gaming session. ■

BY ANDREW LEIBMAN

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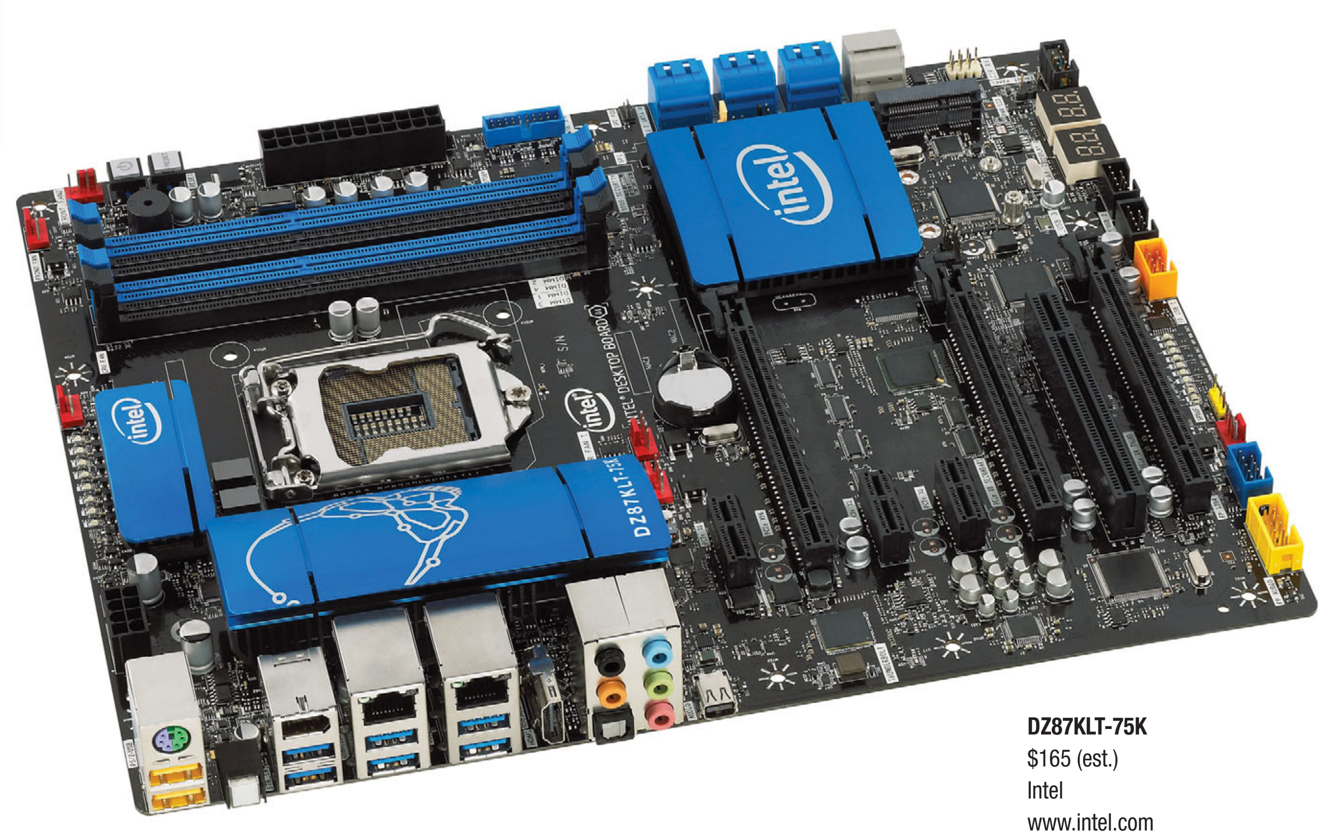
Intel DZ87KLT-75K

The release of Intel's 4th Generation Core processors also bring along the new Z87 enthusiast chipset, which is a must-have when you invest in a Haswell processor.

Other than the new LGA1150 socket, Z87 is fairly similar to Z77. Part of the reason is that newest Intel 4th Generation processors provide the same built-in capabilities (16 PCI-E 3.0 graphics lanes, support for dual-channel DDR3 memory clocked up to 1,600MHz, and Intel HD Graphics) as Intel's Ivy Bridge processors.

That said, the Z87 does build upon the Z77's strong feature set, especially with regard to storage and device connectivity. A stock Z87 chipset offers six 6Gbps SATA ports (which are backward-compatible with 3Gbps SATA) and up to 14 USB ports—the same overall number as Z77, but six of the Z87's ports can be USB 3.0 with, which is two more than the Z77. Intel HD Audio and a 10/100/1000 Intel Ethernet Connection are also stock options with a Z87 board. We got to check out Intel's DZ87KLT-75K and came away impressed with the motherboard's capabilities.

The DZ87KLT-75K supports two-way SLI and CrossFire GPU configurations, making use of Haswell's 16 PCI-E graphics lanes. We'll note that there are three PCI-E x16 slots, but only two of the slots can operate with graphics cards at any time. The PCI-E lanes for the third slot are provided by the Lynx Point PCH, which limits the slot to the PCI-E 2.0 interface and x4 speed. When you install an SLI or CrossFire setup into



DZ87KLT-75K
$165 (est.)
Intel
www.intel.com

the top two PEG slots, they will both run at the x8 speed. Naturally, the top PCI-E x16 slot will run at full x16 speed with one card. Intel also includes three PCI-E x1 slots, a legacy PCI slot, and a PCI-E mini card slot with mSATA SSD support. Intel boosted the DZ87KLT-75K's memory capabilities by supporting up to 32GB of DDR3-2400 over the four DIMM slots.

When it comes to connectivity, the DZ87KLT-75K has pretty much every option covered. First off, there's a Thunderbolt port on the rear panel with a 10Gbps controller that can transmit and receive information over the PCI-E and DisplayPort protocols, so it can work with external storage devices and monitors. On the rear panel, you'll also find six USB 3.0, two USB 2.0, one PS/2, one FireWire (1394a), two Ethernet, one HDMI, an S/PDIF-out, and analog audio ports. Internally, you'll find a USB 3.0 header, three USB 2.0 headers, one FireWire header, and eight 6Gbps SATA ports. Six of the SATA ports (colored blue) support Intel's Rapid Technology that allows you to create a RAID 0, 1, 5, or 10 configuration. Wireless connectivity is also covered, thanks to an add-on module that delivers Bluetooth 2.1 and 802.11b/g/n.

Of course, the DZ87KLT-75K also supports all of the high-end features found in Intel's 4th Generation processors, including Turbo Boost 2.0, Hyper-Threading, and performance tuning of unlocked processors, and Intel HD Graphics. Intel designed this board with overclockers in mind, as you'll find a Back-to-BIOS button, an LED POST decoder, and onboard power/reset switches and status LEDs. Those who require lots of fan connectors will like that the DZ87KLT-75K offers six 4-pin headers, with three located along the top of the motherboard. Large heatsinks are located along the PCH and VRM to handle overclocking frequencies.

We tested the Intel DZ87KLT-75K with Intel's new Core i7-4770K at stock clock speeds. In 3DMark 11, we saw an overall mark of X4140, a higher score than we've seen with Z77 motherboards running similar components. Most CPU-intensive benchmarks ended up around 5% to 10% higher than the most recent Z77 motherboard's we've tested. Other highlights include a Memory Bandwidth of 24.3GBps, which we achieved using DDR3-1866 memory.

Besides support for 4th Generation processors, we like inclusion of Thunderbolt and the rest of the connectivity options, because it provides enthusiasts with maximum flexibility with peripherals, add-in cards, and external storage. Overclocking tools also make this board a good choice those looking to optimize their new Haswell CPU. ■

By Nathan Lake

When it comes to connectivity, the DZ87KLT-75K has pretty much every option covered.

Benchmark Results	Intel DZ87KLT-75K
3DMark 11 Extreme	**X4140**
Graphics Score	3897
Physics Score	9070
Combined Score	4760
PCMark 7	**5734**
Productivity	6420
Creativity	5810
Entertainment	5505
Computation	8900
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POV-Ray 3.7 Beta*	**1538.05**
Cinebench**	**8.04**
Games (2,560 x 1,600)	
Metro 2033 (4XAA, 16XAF)	40
Aliens vs. Predator (4XAA, 16XAF)	53.4

* Pixels per second

** Points

Specs: Max memory: 32GB (DDR3-1600; DDR3-2400 max OC); Slots: 2 PCI-E 3.0 x16, 1 PCI-E 2.0 x16, 3 PCI-E x1, 1 PCI; Storage; 8 6Gbps SATA; Rear I/O: 1 HDMI, 1 Thunderbolt, 6 USB 3.0, 1 FireWire, 2 Ethernet, 1 S/PDIF out, audio I/O; Warranty: 3 years

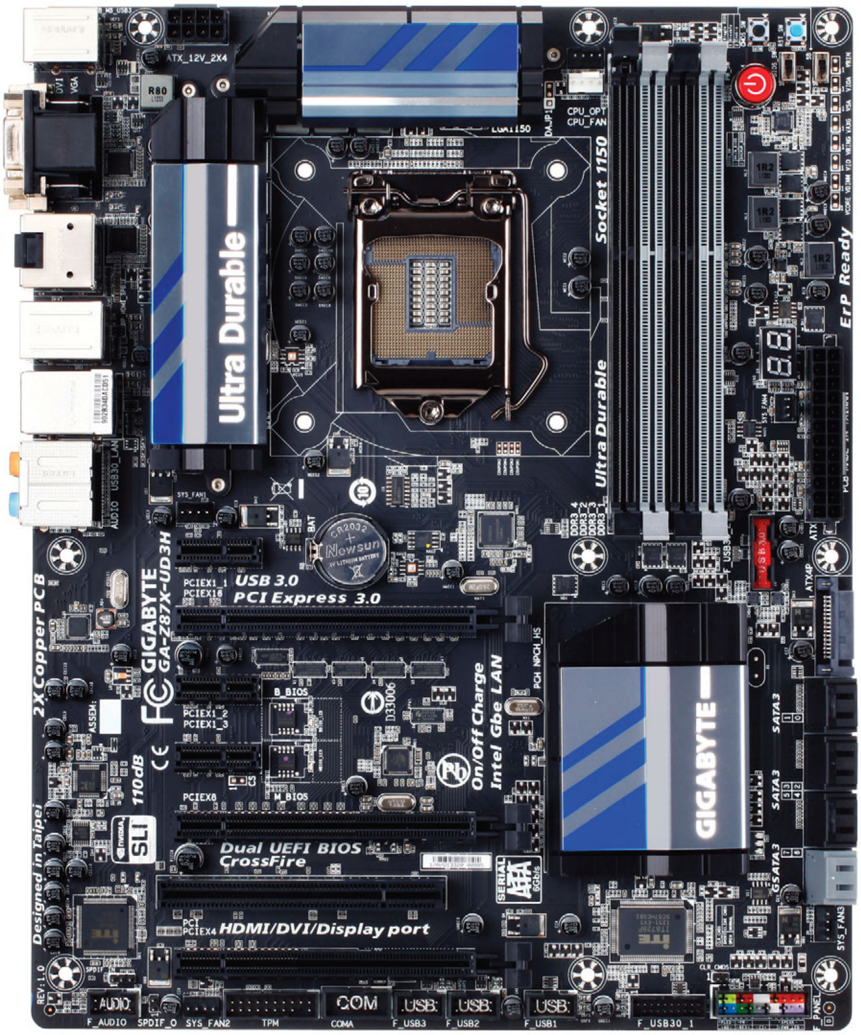
Test system specs: Processor: Intel Core i7-4770K; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8 Enterprise (64-bit)

GIGABYTE GA-Z87X-UD3H

The GA-Z87X-UD3H is our first chance to check out GIGABYTE's take on the Z87 chipset. Gamers will like that this motherboard supports three-way CrossFire and two-way SLI, while performance enthusiasts can take advantage of a host of overclocking tools, including voltage measurement points, a BIOS switch, and onboard buttons for power on, reset, and clear CMOS.

For GPU support, you'll find three PCI-E x16 slots on the GA-Z87X-UD3H. GIGABYTE also provides three PCI-E x1 slots and a legacy PCI slot. If you opt to install an add-in card in the third PCI-E x16 slot, the three PCI-E x1 slots will be unavailable. For storage, you'll find the six 6Gbps SATA ports built into the Z87 chipset, as well as two 6Gbps ports provided by a Marvell 88SE9172 chip. The six 6Gbps SATA ports support RAID 0, 1, 5, and 10 configurations, while the Marvell-powered ports support RAID 0 and 1. The GA-Z87X-UD3H can handle up to 32GB of DDR3 memory, and GIGABYTE lists support for DDR3-1600/1333 modules. It also supports Intel's XMP; we were able to use the XMP profile to set our Kingston HyperX Predator modules to 1,866MHz.

If you opt to use Intel's HD Graphics built into Haswell, you'll like the video output options (HDMI, DisplayPort, DVI, and VGA) found on the motherboard's rear panel. Even better, the HDMI port supports a maximum resolution of 4,096 x 2,160 (at 24Hz), and the DisplayPort supports 3,840 x 2,160 at 60Hz. The rear panel also boasts an S/PDIF output with support for up to 7.1-channel surround sound. The remaining ports of the rear panel consist of six USB 3.0 ports, two 6Gbps eSATA ports, an Ethernet port, and a PS/2 port.



For internal connectivity, there are two USB 3.0 headers, three USB 2.0 headers, and S/PDIF I/O headers. To power fans and peripherals, you'll find four 4-pin fan headers and a SATA power port.

Another key feature is the gaming headphone amplifier that's capable of driving up to 600 ohm loads. Combined with a high-end headset, the amplifier will help to deliver a fuller range of dynamic sound and less distortion than what you'd experience with a typical headphone jack. GIGABYTE has also enhanced its EasyTune software to provide comprehensive control of the CPU/OPT system fans. You'll be able to manage individual fan speeds through the SmartFan panel, and you can also set

the fans to Silent, Standard, and Extreme cooling modes.

GIGABYTE's Ultra 5 Durable Plus heatsinks handle the cooling of the PWM and PCH areas of the motherboard. The wide heatsinks allow you to take advantage of overclocking configurations, because the passive cooling will keep the PWM and PCH within thermal parameters. The board is also built with GIGABYTE's PowIRstage controllers that provide 100% digital power to your motherboard's components for precise power delivery.

In the March 2013 issue, we tested GIGABYTE's GA-Z77X-UD4H, which featured similar base components (with the obvious exception of a different CPU) to our test rig for the GA-Z87X-UD3H. In 3DMark 11, we saw an improvement from X3875 to X4230 (9.16% increase), while PCMark 7's overall score improved from 5345 to 5676 (6.19% increase). Gaming scores remained similar, but we did see a boost in Cinebench 11.5 and POV-Ray 3.7 Beta.

The GA-Z87X-UD3H provides all the capabilities ideal for performance enthusiasts and gamers looking to move to the Z87 chipset. We also like the added connectivity for SATA, eSATA, and video outputs, as the ports provide you with added flexibility with your build and peripherals. ■

BY NATHAN LAKE

GA-Z87X-UD3H
Price TBD
GIGABYTE
www.gigabyte.us

Benchmark Results	GIGABYTE GA-Z87X-UD3H
3DMark 11 Extreme	**X4230**
Graphics Score	3913
Physics Score	9050
Combined Score	4786
PCMark 7	**5676**
Productivity	6394
Creativity	5781
Entertainment	5517
Computation	8896
System Storage	5203
SiSoftware Sandra 2013 SP2 Lite	
Dhrystone AVX2 (GIPS)	130.2
Whetstone iSSE3 (GFLOPS)	94.74
x32 Multi-Media Integer AVX2 (Mpixels/s)	400.94
x16 Multi-Media Float FMA3 (Mpixels/s)	399.52
Integer B/F AVX/128 (GBps)	24.4
Floating B/F AVX/128	24.1
POV-Ray 3.7 Beta*	**1538.05**
Cinebench 11.5**	**9.04**
Games (2,560 x 1,600)	
Metro 2033 (4XAA, 16XF)	40
Aliens vs. Predator (4XAA, 16XAF)	53.4

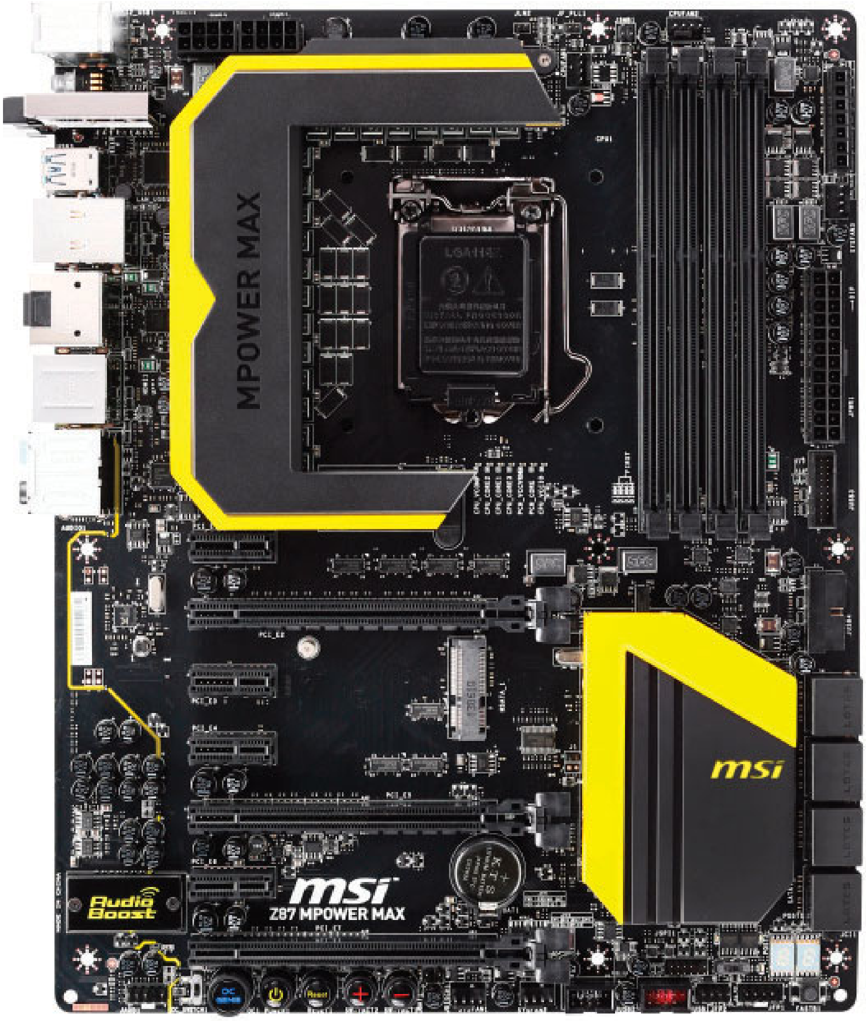
* pixels per second

** points

Specs: Max memory: 32GB (DDR3-1600/1333); Slots: 2 PCI-E 3.0 x16, 1 PCI-E 2.0 x16, 3 PCI-E x1, 1 PCI; Storage: 8 6Gbps SATA; Rear I/O: 1 HDMI, 1 DisplayPort, 1 DVI, 1 VGA; 6 USB 3.0, 2 6Gbps eSATA, 1 Ethernet, 1 S/PDIF out, audio I/O, 1 PS/2 port; Warranty: 3 years

Test system specs: Processor: Intel Core i7-4770K; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8 Enterprise (64-bit)

MSI Z87 MPOWER MAX



MSI's Z87 MPOWER MAX is a motherboard built for overclocking and gaming, offering features power users and gamers crave, such as support for DDR3-3000, three-way CrossFire, and two-way SLI. The Z87 MPOWER MAX also lets you optimize your PC's network connection, thanks to the inclusion of Killer's E2205 Gigabit LAN controller.

MSI built the Z87 MPOWER MAX with its Military Class 4 components, including Hi-c CAPs (allows for 93% power efficiency), Super Ferrite Chokes (better overclocking and power stability), and Dark CAPs (10-year life span). For even more stability, MSI redesigned the circuit board with six layers of PCB to isolate all power and signal traces. MSI indicates that the design allows components to be installed closer to each other without causing electrical interference. MSI also optimized the board layout for low airflow environments, such as systems that have extensive liquid-cooling setups.

Because it's likely you'll be overclocking the processor with this board, MSI delivers features that enhance the experience. Voltage checkpoints (that physically hold the positive lead for multimeter) are provided for the CPU core voltage, graphics voltage, memory voltage, and other integrated controllers. For an even further breakdown of the CPU voltage, you'll find voltage checkpoints for the individual CPU cores, PCH core, VRM voltage, Vcomp voltage, and IO voltage.

The Z87 MPOWER MAX comes with two BIOS ROMs. If one crashes, you can simply slide the switch to boot into the functioning BIOS. You'll also find an OC GENIE switch that lets you jump between the Gear 1 and Gear 2 overclocking modes, which are preconfigurd by MSI. A set of + and – buttons let you adjust your base clock (default is 1MHz) in real time, and you can select increments as large as 1MHz or as small as 0.1MHz in MSI's Direct OC software.

Another performance enhancement in the Z87 MPOWER MAX is the built-in RAMDisk software, which lets you create a high-speed (20x faster than a modern SSD) virtual drive from your system memory. You can use the RAMDisk to store things such as game images.

For great audio fidelity, you can use MSI Audio Boost, which is a built-in headphone amplifier (600 ohms) and an EMI-shielded audio codec. For

> For an even further breakdown of the CPU voltage, you'll find voltage checkpoints for the individual CPU cores, PCH core, VRM voltage, Vcomp voltage, and IO voltage.

wireless connectivity, MSI provides a small module that connects to the motherboard's rear I/O panel and provides 802.11b/g/n, Bluetooth 4.0, and Intel WiDi. Two large external antennas help increase range.

The MSI Z87 MPOWER MAX produced some of the highest benchmarks we've seen with the new Z87 chipset. Just a few examples of the high scores include a 1624.22pps in POV-Ray 3.7 beta, 54fps in the Aliens vs. Predator benchmark, and a memory bandwidth of 24.65GBps (integer) and 24.74GBps (floating).

As you can see, MSI's enhancements provide you with extra speed for multiple components. The Z87 MPOWER MAX should help you get the highest frame rates and the lowest load times, so you'll be able to build a rig without bottlenecks. ■

BY NATHAN LAKE

Z87 MPOWER MAX
$259.99
MSI
us.msi.com

Benchmark Results	MSI Z87 MPOWER MAX
3DMark 11 Extreme	**X4259**
Graphics Score	3916
Physics Score	10442
Combined Score	4784
PCMark 7	**6211**
Productivity	6403
Creativity	5865
Entertainment	8459
Computation	9055
System Storage	5024
SiSoftware Sandra 2013 SP2 Lite	
Dhrystone AVX2 (GIPS)	137.89
Whetstone iSSE3 (GFLOPS)	100.83
x32 Multi-Media Integer AVX2 (Mpixels/s)	425.42
x16 Multi-Media Float FMA3 (Mpixels/s)	415.84
Integer B/F AVX/128 (GBps)	24.65
Floating B/F AVX/128	24.74
POV-Ray 3.7 Beta*	**1624.22**
Cinebench 11.5**	**8.58**
Games (2,560 x 1,600)	
Metro 2033 (4XAA, 16XF)	40.39
Aliens vs. Predator (4XAA, 16XAF)	54

* pixels per second

** points

Specs: Max memory: 32GB (DDR3-1600/Max OC: DDR3-3000); Slots: 3 PCI-E 3.0 x16, 4 PCI-E x1; Storage: 8 6Gbps SATA; Rear I/O: 2 HDMI, 1 DisplayPort, 6 USB 3.0, 2 USB 2.0, 1 Killer E2205 Ethernet; S/PDIF out, audio I/O

Test system specs: Processor: Intel Core i7-4770K; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8 Enterprise (64-bit)

MSI Z87-GD65 GAMING

Unleash The Power Of Haswell

Z87-GD65 GAMING
$189.99
MSI
us.msi.com

Even the best CPU is only as good as its motherboard will let it be. A board's overclocking capabilities, audio reproduction, and network latency can all make tangible differences in your gaming experience. With the Z87-GD65 GAMING, MSI gives you the tools to increase frame rates, hear your enemies better, reduce lag, and take full advantage of Intel's new Haswell processors.

Overclocks

MSI engineered the Z87-GD65 GAMING to provide easy, flexible overclocking. A switch on the board lets you choose between OC and Gaming modes, and the OC GENIE button completes the overclock in less than one second. OC mode increases the Intel Core i7-4770K's default 3.5GHz clock speed to 4GHz; switching to Gaming mode will bump the CPU up to 4.2GHz. Of course, you can also enter the OC area of the BIOS to make custom frequency and voltage adjustments. The Z87-GD65 GAMING even lets you create preset OC profiles, so you can quickly switch based on the task at hand. MSI built in two BIOS ROMS, and the board can switch from one to the other in the event of a crash during overclocking.

Gaming Network

The Z87-GD65 GAMING features Killer's E2200 networking chip, which recognizes game data packets and prioritizes them over other network data. This helps to avoid lag and optimizes your response time, giving you a leg up on the competition. The bundled software even lets you choose which games and apps you'd like to have processed first.

Studio-Quality Sound

A built-in headphone amplifier helps the Z87-GD65 GAMING provide optimal in-game sound when used with high-end headphones. Sound Blaster Cinema is also onboard, and the resulting surround sound environment makes it easier to hear where your enemies are. For pure audio quality, the audio outputs feature gold jacks, and there's an EMI-shielded audio codec on the PCB.

Multi GPU

This motherboard supports three-way CrossFire and two-way SLI GPU configurations via its three PCI-E x16 slots. When two cards are installed in the first two slots, both will run at x8 speed. MSI also adds LucidLogix's Virtu MVP 2 that can boost gaming responsiveness (using both your integrated and discrete GPU), sharpen visual quality, and increase Vsync. Other add-in cards can be installed into the four PCI-E x1 slots on the motherboard.

Gaming Device Port

At the top of the rear panel, you'll find two USB 2.0 ports and a PS/2 port that have been optimized for high-polling-rate mice and keyboards. You'll also find thicker gold plating around the ports for improved durability when plugging and unplugging. ■

Advertisement

Aivia Osmium
$129.99
GIGABYTE
www.gigabyte.us

GIGABYTE Aivia Osmium

Osmium is known as the densest naturally occurring element, and GIGABYTE indicates that its "hard, rare, and noble nature" represents the durability and luxury of the keyboard. Just some of these lavish features include the choice between Cherry MX Red or Brown keyswitches, a USB 3.0 extension port, line out and microphone connections, and antighosting capability for up to 64 simultaneous presses when connected via USB.

Gamers who play MMO and RTS games will appreciate that the Aivia Osmium lets you store up to five different profiles and can hold up to 70 macros. GIGABYTE includes its GHOST Macro Engine software that lets you predefine macro keys, rather than having to manually capture and record them. The macro keys are located along the top row, above the Function keys. Next to the macro keys, you'll find two scroll wheels. One controls the brightness of the LEDs in the keys, and the other lets you adjust the volume of headphones you have connected.

The F1-F4 keys double as video playback controls, so you can play/pause, stop, rewind, and fast-forward content directly from the keyboard. A full-sized wrist rest is included to provide comfort for long gaming sessions, and there are additional feet stands to ensure the wrist rest stays in place. To connect to your PC, GIGABYTE provides a 6.5-foot-long cotton-braided cord that contains the two audio plugs, the USB 3.0 extension plug, and the USB 2.0 keyboard input—all of which feature 18K gold-plated connectors.

By virtue of their Cherry MX keyswitches, the Aivia Osmium's keys are rated to last for 50 million key presses, which represent quite a few games of DOTA 2. GIGABYTE did a bit of tinkering, though, and shortened their actuation distance from 4mm to 2mm, so you can expect this keyboard to be highly responsive and very fast.

The Aivia Osmium sent to us featured Cherry MX Brown switches that provided pleasant tactile feedback during our game testing. We also like that the Aivia Osmium offered an insane number of macros. Its ability to handle 64-key rollover via USB means that you won't need to have a PS/2 port on your motherboard to handle long, complex macros. ■

BY NATHAN LAKE

Specs: Interface: USB; Cable length: 6.5 feet; Cherry MX Brown or Red mechanical keyswitches; 64-key rollover; Backlight: Blue, custom brightness level

GT1
$69
In Win
www.inwin-style.com

In Win GT1

The black-painted steel-framed In Win GT1 takes its sports car-inspired namesake seriously. The top of the plastic front panel features a pair of blue headlights on either side of the front panel ports, which include two USB 2.0 ports, one USB 3.0 port, and mic and line out ports. Power and reset buttons are on the front edge of the all-plastic top panel, and the former is LED-backlit. A switch on the top panel also lets you toggle fans between silent and turbo modes. The "hood" also features a faux carbon fiber ramp with SATA power and data ports that let you connect a 3.5-inch or 2.5-inch HDD or SSD.

There are two 120mm fan slots in the top panel and another two in the front panel. In Win ships the GT1 with a front panel fan in the lower slot. It also has a removable dust filter clipped to the front of it. You'll find two more dust filters on the bottom panel, one under the PSU and another under an internal 120mm fan bay. There are three external 5.25-inch drive bays with metal mesh bay covers. The front panel also has a series of 18 air intake ports, and In Win gives you red plastic accents that you can snap in to add some color to the front panel.

The left side panel features a large window that protrudes approximately a quarter of an inch from the panel. In Win's logo adorns the panel on the unit we tested. The right side panel features a beveled convexity that gives you some extra cable routing room. There are two rubber grommeted ports on the rear panel, above the included 120mm red LED exhaust fan, which can support an external liquid-cooling radiator.

Inside the GT1, you'll find room for six 3.5-inch HDDs or 2.5-inch SSDs. You can flex the plastic trays onto HDDs, and the rubber bumpers around the tray's pegs can reduce drive vibration. A quartet of screw holes in each tray support 2.5-inch storage drives. You can remove the left side wall to the middle drive cage, which costs you space for two storage drives but gives you an extra four inches of room for graphics cards longer than 12 inches. In Win also gives you a spare 2.5-inch drive mount on top of the lower drive cage.

There's enough room inside to support CPU coolers approximately 6.5 inches tall. There are ports in the motherboard tray to route PSU cables around the motherboard, and the metal edges are all rolled so there's no chance you'll carve grooves into your cables.

Aesthetics are always subjective, but we can't help but be impressed by how slick the GT1 looks, especially given its price. There are quite a few enthusiast features here that make this case worth considering for your next build.

BY ANDREW LEIBMAN

Specs: Dimensions: 18.7 x 8.3 x 19.3 inches (HxWxD); Motherboard support: ATX, mATX; Bays: 3 5.25-inch external, 6 3.5/2.5-inch internal, 1x 2.5-inch internal; Fans (included): 1 120mm front, 1 red LED 120mm rear; Fans (optional): 1 120mm front, 2 120mm side (mesh side panel only), 2 120mm top, 1 120mm bottom; Ports: 2 USB 2.0, 1 USB 3.0, audio I/O

ETS-40-BK
$49.99
ENERMAX
www.ecomastetek.com

ENERMAX ETS-40-BK

When you produce a CPU cooler that performs well, looks awesome, and doesn't cost an arm and a leg, you've basically achieved hardware Zen. Can it then be said that ENERMAX, with its lineup of no less than five ETS-T40 air coolers, is the Zen master of CPU cooling? We think it can, and present to you our supporting evidence: the ETS-40-BK.

ENERMAX lays a good foundation with the ETS-40-BK's heatsink. This is same heatsink that we've covered in previous ETS-40 reviews, so it's loaded with a bunch of patented technologies, which ENERMAX uses to good effect. The ETS-40-BK's four 6mm heatpipes form the bulk of its base to make direct contact with a CPU's heat spreader. ENERMAX calls this HDT, or Heat-pipe Direct Touch. Further up, VGF (Vortex Generator Flow) increases air convection between the cooler's aluminum fins, while VEF (Vacuum Effect), improves airflow inside the cooler. ENERMAX also uses its TCC (Thermal Conductive Coating), which creates better thermal transfer velocity and prevents surface oxidation, according to ENERMAX.

The ETS-40-BK's fan is impressive in its own right. This isn't your typical run-of-the-mill 120mm fan. The T.B. APOLLISH is one of ENERMAX's patented circular LED fans, and it's a thing to behold when it's spinning up a storm (and as far as said spinning goes, the PWM fan's range is 800 to 1,800rpm, based on load). The fan also has an antivibration coating that absorbs and minimizes noise, which helps explain why the ETS-40-BK's noise rating is 16 to 26dBA. By the way, the "T.B." stands for "Twister Bearing," ENERMAX's proprietary fan tech that uses magnets, rather than oil, to stabilize the fan's bearing. These fans should last longer and run quieter over time than traditional fans. An additional set of mounting clips is included if you want to add a second fan.

Thanks to the included universal mounting bracket, the ETS-40-BK is compatible with all of Intel's and AMD's current CPU sockets, including Intel's new LGA1150 socket. Yes, this cooler is Haswell-ready.

To test the ETS-40-BK, we installed it in a test system consisting of an Intel Core i7-4770K, MSI Z87 MPOWER MAX motherboard, 16GB of Kingston HyperX Predator DDR3-1866, and two ZOTAC GeForce GTX 580s in SLI. We let the CPU idle for 30 minutes and then measured the CPU temp in Core Temp. With the ETS-40-BK installed the idle temp was 39 degrees Celsius. Then, we had some fun. We ran a couple of CPU-intensive benchmarks, POV-Ray 3.7 Beta (looped three times) and Prime95 (Small FFTs test on each core for 10 minutes). In POV-Ray, we recorded a temperature of 67 C, and in Prime95 the mercury read 66 C. We like those apples a lot.

The ETS-40-BK is effective, eye-catching, and budget-friendly. What's not to like? ■

BY VINCE COGLEY

Specs: Materials: Copper (heatpipes), aluminum (fins); Socket compatibility: Intel LGA775/1150/1155/1156/1366/2011, AMD AM2/AM2+/AM3/AM3+/FM1/FM2; Fan: 1 120mm LED (800 to 1,800rpm); Dimensions: 6.3 x 5.5 x 3.7 inches (HxWxD)

Test system specs: CPU: Intel Core i7-4770K; Motherboard: MSI Z87 MPOWER MAX; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8

Intel Core i7-4770K

Intel's lineup of 4th Generation Core processors, codenamed "Haswell," provides solid improvements in graphics power and CPU efficiency across the entire lineup. Are these advancements worth the investment? Read on to find out.

Intel's HD Graphics is one of the big winners with Haswell. Most 4th Generation Intel Core i7 and Core i5 chips come with Intel HD Graphics 4600. The Core i7-4770K sent to us features a maximum HD Graphics frequency of 1,250MHz. By comparison, Intel's Core i7-3770K offers a maximum frequency of 1,150MHz. With an Intel 8 Series chipset, you can take advantage of an unlocked graphics multiplier on Haswell processors with a "K" suffix.

Motherboard manufacturers can opt to configure their boards' video outputs (up to three) as DisplayPort, HDMI, or DVI. You'll still be able to span the Intel HD Graphics across three monitors. Haswell processors also come with built-in Intel Wi-Di.

Intel has also expanded the instruction set to help with gaming, multimedia encoding, and high-performance computing. AVX2 (Advanced Vector Extension 2) comes with 256-bit integer instructions, floating-point FMA (fused multiply-add) instructions, and gather operations. The new FMA tools help with things like face detection and digital imaging, while the gather operations improve bit manipulation in compression, encryption, and general-purpose software. Haswell also improves Intel Quick Sync Video, InTru 3D, and Clear Video HD Technology.

The Intel Core i7-4770K is an unlocked processor with four cores, Hyper-Threading, and 8MB of Intel Smart Cache. The Core i7-4770K's maximum TDP is 84W, seven watts higher than the Core i7-3770K. The memory controller supports DDR3 speeds of 1,333MHz and 1,600MHz by default, while the processor's PCI-E 3.0 controller provides 16 lanes for graphics.

Despite having similar basic specs as the Core i7-3770K, we saw increases across the board in our CPU-intensive benchmarks. Intel's HD Graphics 4600 really shined, too. Overall numbers in 3DMark 11 jumped from E1588 to E2675, a 68% increase. We were able to produce playable frame rates in Metro 2033 and Aliens vs. Predator by lowering settings to Medium, turning off AF, and running games at 1,024 x 768—something we weren't able to produce with Intel HD Graphics 4000.

The performance increases over Ivy Bridge, plus the changes to Intel's HD Graphics, make the Core i7-4770K a smart pick for power users eyeing a new build in 2013. Haswell can hold its own. ■

BY NATHAN LAKE

Core i7-4770K
$339
Intel
www.intel.com

Benchmark Results	Intel Core i7-4770K
3DMark 11 Entry	**E2675**
Graphics Score	2332
Physics Score	8202
Combined Score	2031
PCMark 7	6357
Productivity	6274
Creativity	5848
Entertainment	9215
Computation	17906
System Storage	5145
SiSoftware Sandra 2013 SP2 Lite	
Dhrystone SSE4.2	130.42 GIPS
Whetstone iSSE3	95.46 GFLOPS
x32 Multi-Media Integer AVX2 (Mpixels/s)	401.81
x16 Multi-Media Float FMA3 (Mpixels/s)	395
x8 Multi-Media Double FMA3 (Mpixels/s)	227.69
Integer B/F AVX/128 (GBps)	23.9
Floating B/F AVX/128 (GBps)	24.1
POV-Ray 3.7 Beta*	**1538.17**
Cinebench	**8.09**
Games	**1,024 x 768**
Metro 2033 (4XAA)	31.67
Aliens vs. Predator (4XAA)	29.4
* pixels per second	** points

Specs: Socket: Intel LGA1150; Clock speed: 3.5GHz (3.9GHz Turbo); 8MB Intel Smart Cache; TDP: 84W; Cores: 4; Hyper-Threading: Yes; Graphics Max Dynamic Frequency: 1,250MHz
Test system specs: Motherboard: GIGABYTE GA-Z87X-UD3H; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8 Enterprise (64-bit)

Water 3.0 Extreme
$109.99
Thermaltake
www.thermaltakeusa.com

Thermaltake Water 3.0 Extreme

Similar to Thermaltake's Water 2.0 Extreme, the Water 3.0 Extreme boasts a 240mm radiator and a Fan Control utility that lets you adjust the fan speed to customize cooling performance/noise level. Thermaltake has enhanced the 3.0 version of the closed-loop cooler, adding support for Intel's LGA1150 socket and using double-curve fans that operate between 1,000 and 2,000rpm. Compared the Water 2.0's sweep-style blade fans, Thermaltake increases the maximum airflow (from 81.32 to 99cfm) while reducing noise levels (from 27.35dBA to 20dBA).

The Water 3.0 Extreme is built with a high-performance waterblock that features a full copper plate. Thermaltake preapplies thermal compound to the plate, too. The 12V pump built into the waterblock is capable of operating at 3,000rpm—give or take 150rpm. To automatically control the speed of the fans, the pump has two PWM 4-pin power connectors, and the unit connects to the motherboard via a separate 4-pin connector. To utilize the Fan Control utility, you'll need to run the USB plug to a USB header on your motherboard.

The Fan Control software provides the following data: real-time CPU temperature, coolant temperature, and fan speed. Thermaltake designed the Fan Control utility with three profiles: Extreme (fans run at 2,000rpm), Silent (fans run around 1,000rpm), and Custom. The latter allows you to set a fan speed level that you prefer. The installation process is similar to other closed-loop CPU coolers we've tested. You install an Intel or AMD mounting bracket onto the waterblock and lock it in with a retention ring. Then, you select the matching backplate and screw the mounting bracket to the backplate. In all, the Water 3.0 Extreme supports Intel LGA1150/1155/1156/1366/2011 and AMD AM2/AM2+/AM3/AM3+/FM1/FM2 sockets.

We tested the Water 3.0 Extreme using the Extreme setting. At idle, the closed-loop cooler produced a temperature of 25 degrees Celsius. To stress-test the Water 3.0 Extreme, we ran POV-Ray 3.7 for 10 minutes on Intel's Core i7-3770K (stock-clocked) and saw an impressively low maximum temperature of 56 C. We also ran four simultaneous instances of Prime 95, and the Water 3.0 Extreme delivered a maximum temperature of 58 C. In both stress tests, temperatures routinely hovered around 50 C, which are fairly low load temps for the 3770K.

The Water 3.0 Extreme is a performance CPU cooler that should allow for some hefty overclocks. Compatibility with a wide variety of CPU sockets and the thin 240mm radiator means it should fit in most cases with a top panel that allows for two 120mm fans. ■

BY NATHAN LAKE

Specs: Materials: Copper (waterblock), aluminum (radiator); Fans: 2 120mm (1,000 to 2,000rpm); Pump motor speed: 3,000rpm; Warranty: 3 years
Test system specs: Processor: Intel Core i7-3770K; Motherboard: GIGABYTE GA-Z77X-UD4H; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 7 Enterprise (64-bit)

ETS-40-W
$49.99
ENERMAX
www.ecomastetek.com

ENERMAX ETS-40-W

If you think you're suffering from déjà vu, don't panic. There are, in fact, two of ENERMAX's ETS-T40 CPU coolers in this issue. You're looking at the ETS-T40-W; elsewhere in this issue, its brother the ETS-T40-BK is lurking, waiting to be discovered.

Indeed, all of the ETS-T40s share the same DNA. ENERMAX has developed a bunch of proprietary technologies to help improve airflow and thermal transfer, and incorporated those technologies into the ETS-T40 coolers. HDT (Heat-pipe Direct Touch) is probably the most obvious. The ETS-T40-W's four 6mm copper heatsinks swoop down and become part of the heatsink's base, thus directly contacting your CPU's heat spreader for faster, more efficient thermal transfer. VEF (Vacuum Effect) and SEF (Stack Effect) "improve thermal conductivity" and "optimize airflow inside the cooler," respectively, according to ENERMAX. VGF (Vortex Generator Flow) boosts air convection between the heatsink's fins, while ENERMAX applies TCC (Thermal Conductive Coating) to prevent oxidation and aid heat transfer.

Of course, what really stands out on the ETS-T40-W is its color. This CPU cooler is white done right: The heatsink's fins and heatpipes are anodized in brilliant white, and the fan is white, too. Even the fan's power cable has white sheathing. The ETS-T40-W is practically begging for a white case. While you're at it, get yourself a white PSU and white memory to complete the look.

The 120mm PWM fan has LED lights to supply even more flair, and it also features ENERMAX's new APS (Adjustable Peak Speed) technology. Before you install the cooler, remove the fan from the heatsink and find a small switch on the back near the center of the fan. This lets you cap the fan's maximum speed at 1,500rpm (Silence), 1,800rpm (Performance), or 2,200rpm (Overclock), so you can strike the right balance between performance and noise. The fan's lowest speed, 800rpm, remains the same regardless of the setting you choose. As with the ETS-40-BK, you can install a second 120mm fan using the included fan clips.

We ran the ETS-40-W through the same series of benchmarks we used to test the ETS-40-BK. First, we let our CPU (Intel's Core i7-4770K) idle for 30 minutes. Using Core Temp, we recorded an idle temp of 37 degrees Celsius with the ETS-40-W. Next, we turned up the heat using POV-Ray 3.7 Beta and Prime95, two benchmarks that put tremendous strain on the CPU, thus driving up temperatures. We looped POV-Ray 3.7 Beta three times, and our CPU's temp rose to 64 C. When we ran Prime95's Small FFTs test on all four of the 4770K's cores, Core Temp reported a temp of 67 C. Not surprisingly, the ETS-40-W's numbers are virtually identical to the ETS-40-BK's.

For 50 bucks, that makes the ETS-40-W an attractive cooler, both from a price/performance and a visual standpoint. ■

BY VINCE COGLEY

Specs: Materials: Copper (heatpipes), aluminum (fins); Socket compatibility: Intel LGA775/1150/1155/1156/1366/2011, AMD AM2/AM2+/AM3/AM3+/FM1/FM2; Fan: 1 120mm LED (800 to 2,200rpm); Dimensions: 6.3 x 5.5 x 3.7 inches (HxWxD)
Test system specs: CPU: Intel Core i7-4770K; Motherboard: MSI Z87 MPOWER MAX; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 8

NiC C4
$49.99
Thermaltake
www.thermaltakeusa.com

Thermaltake NiC C4

Last month, we tested the NiC (non-interference cooler) C5, the flagship model for Thermaltake's newest heatsink/fan CPU coolers. The NiC C4, like the C5, is designed to provide high-performance cooling without extending over the RAM on your motherboard. The slim cooler helps to ensure you'll have clearance to install memory modules with tall heat spreaders. The NiC C4 looks nearly identical to the C5, and in practice, the only difference between the two is that the NiC C5 has five heatpipes (supports 230 watts of cooling power) and the NiC C4 has four heat pipes (supports 220 watts of cooling power).

The NiC C4 comes with two 120mm VR (voltage regulation) fans that you can control using the speed knob built into the fan's power cables. You can set the fans to run as slow as 1,000rpm or as a fast as 2,000rpm, which produces a noise level range of 20 to 39.9dBA. At 2,000rpm, the fans can combine for up to 99.1cfm of airflow. The two fans clip into the fan shroud, which then slips over the tower of aluminum fins. Thermaltake indicates that the aluminum fins are designed with a curved shape to deliver maximum airflow and reduce back pressure.

Thermaltake provides universal CPU socket support with brackets that can handle today's Intel and AMD sockets. For Intel, there's a bracket for LGA775/1150/1155/1156/1366/2011 sockets. For AMD, you'll find support for AM2/AM2+/AM3/AM3+/FM1/FM2 sockets. The installation process for the universal backplate consists of inserting screws through the backplate (on the back of the motherboard) and hand-tightening bolts to secure the backplate. Then, you can remove the fan shroud (and install the appropriate mounting bracket onto the heatsink. Finally, screw down the heatsink to the threads above bolts and add the fans.

Our test system included an Intel Core i7-3770K, two ZOTAC GeForce GTX 580s in SLI, and 16GB of Kingston's HyperX Predator DDR3-1866. We ran at the processor at stock clock speed for 30 minutes in idle, and it delivered a temperate of 33 degrees Celsius. To stress-test the CPU cooler, we ran two tests separately for 10 minutes each: POV-Ray 3.7 Beta and four instances of Prime95's Small FFTs test. In POV-Ray 3.7, we saw a maximum temperature of 65 C, while Prime95 pushed the processor to a maximum temperature of 66 C.

Based on our testing, the Thermaltake NiC C4 would provide around 40 C of overclocking headroom for the Core i7-3770K. We also like the ease of installation, and of course, compatibility with today's tall, high performance memory. All in all, the NiC C4 is a good fit for performance enthusiasts. ■

BY NATHAN LAKE

Specs: Materials: Copper (base, heatpipes), aluminum (fins); Fans: 2 120mm (1,000 to 2,000rpm); Dimensions: 6.3 x 5.9 x 3.7 inches (HxWxD); Warranty: 2 years

Test system specs: Processor: Intel Core i7-3770K; Motherboard: GIGABYTE GA-Z77X-UD4H; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Kingston HyperX Predator DDR3-1866; Storage: 128GB Crucial RealSSD C300; OS: Windows 7 Enterprise (64-bit)

FX100
$69.99
Zalman
www.zalman.com

Zalman FX100

Don't look now, but 2013 could be the year of the heatsink. In the May 2013 issue, we experimented with a CPU cooler by removing its fans and letting the heatsink work alone. The end result was a smashing success: Our heatsink handled the CPU cooling responsibilities on its own, without making a peep in the process. Going fanless wasn't what the cooler's manufacturer intended, but it worked nonetheless.

With the FX100, going fanless was Zalman's intention from the beginning. A lattice of 10 high-performance heatpipes pulls most of the weight, and Zalman slips a shroud full of aluminum fins over the heatpipes. This is how the FX100 works its mojo. So, for those of you keeping score at home, the FX100 is capable of cooling your CPU while producing no noise and no vibration. There's no fan that will wear out, ever, and there's no coolant to flush. The FX100 is a big brick of a cooler that should theoretically last you forever.

Did we mention the FX100 looks great, too? Zalman didn't just say, "Here's your boring pile of metal—enjoy." This cooler matches its ice-cold performance with black-tie style. The black-pearl nickel plating is as sharp as ever, and we dig the design of the FX100's shroud.

The FX100 can optionally accept a 92mm fan. (The ZM-F2Q(BL) is Zalman's official recommendation.) This deserves a mention because, according to Zalman, you actually need the fan in order to use the FX100 with Intel's LGA1366/2011 CPUs. Universal CPU compatibility is a nice notion, but you buy a cooler like the FX100 precisely so you don't have to use a fan. If you have an LGA1366/2011 and you're looking for a cooler upgrade, we'd point you to Zalman's CNPS14X or LQ320, for example.

In order to install the FX100, you'll need a Philips screwdriver that has decently long (at least 6 inches, we'd say) and narrow shaft. You have to slip the screwdriver between the FX100's aluminum fins in order to tighten a pair of screws that secures the heatsink to the rest of the FX100's mounting assembly. Without a screwdriver like this, installing the cooler will require a little creativity—nothing a power user can't handle, though.

To test the FX100, we strapped it to an Intel Core i7-4770K running at stock speeds (3.5GHz base, 3.9GHz Turbo). While idling, the 4770K's temperature held steady at 40 degrees Celsius. Then, we turned up the heat by running three consecutive instances of POV-Ray 3.7 Beta. The FX100 kept the mercury in check at 84 C, so we did the only sensible thing and pushed back with Prime95's Small FFTs test, which we ran on every core for 10 minutes. Here, Core Temp read 81 C. These load temps are about as high as we'd push the 4770K, but as long as your case has decent airflow, you should be set.

We're glad that Zalman boldly stepped up to plate with the FX100. This mute, monolithic CPU cooler is a home run. ■

BY VINCE COGLEY

Specs: Materials: Copper, aluminum; Socket compatibility: Intel LGA775/1155/1156/1366/2011, AMD AM2/AM2+/AM3/AM3+/FM1/FM2; Dimensions: 6.2 x 6.1 x 6.1 inches (HxWxD)

Test system specs: CPU: Intel Core i7-4770K; Motherboard: MSI Z87 MPOWER MAX; GPU: ZOTAC GeForce GTX 580 (2x, SLI); RAM: 16GB Patriot Viper Xtreme DDR3-1600; Storage: 128GB Crucial RealSSD C300; OS: Windows 8

DESERT FOX COMMANDER III 800W
$139
IN WIN
www.inwin-style.com

IN WIN DESERT FOX COMMANDER III 800W

Looking to create a military theme to your case? The DESERT FOX lineup of power supplies from IN WIN offers a desert camouflage color, as well as a military stencil, which gives the power supply a unique look. The DESERT FOX COMMANDER III 800W also provides you with partially modular cable design to let you minimize cable visibility and improve airflow.

For hardwired cables, you'll find the 20+4-pin main power, 4+4-pin +12V ATX, and two PCI-E 6+2-pin cables. For modular options, you'll find a second set of PCI-E 6+2-pin connectors, nine SATA connectors (split between three cables), three Molex connectors (one cable), and one FDD (included on the cable with Molex connectors). All of the cables feature thick mesh sleeves that would be extremely difficult to pierce, so you know that the wiring is protected. Including cable bend, the DESERT FOX COMMANDER III 800W is a mere 7.3 inches long, which is around an inch smaller than many of the other power supplies in this roundup.

IN WIN builds this power supply with four +12V rails that can each handle up to 25A. The total maximum wattage of the four 25A rails is 790 watts. The +5.5V and +3.3V rails can each provide up to 24A and a total of 120 watts. The DESERT FOX COMMANDER III 800W reaches a peak efficiency of 90%, and it meets the 80 PLUS Gold certification. For increased efficiency and reliability, IN WIN indicates that it builds the power supply with 3 ounces of copper in the PCB. To reduce noise level, the unit is built with a 135mm, double ball bearing, PWM fan.

The DESERT FOX COMMANDER III 800W sent to us posted a maximum wattage of 410W and a power factor .961 when benchmarked with one ZOTAC GeForce GTX 580. It also delivered a maximum voltage of 117.2V and a maximum amperage of 3.64A. With two GPUs, we saw an increase in both wattage (up to 627 watts) and power factor (up to .970). Maximum voltage rose slightly to 117.4V, and amperage jumped to 5.52A.

We like the overall look, modular design, and comparatively compact size of the DESERT FOX COMMANDER III 800W. Support for SLI and CrossFire also gives it the capability to handle many power user builds. IN WIN backs this model with a five-year warranty. ■

BY NATHAN LAKE

Specs: 12V rails: 4; +12V max (A): 25A each; +5V max (A): 24A; +3.3V max (A): 24A; SLI/CrossFire-ready: Yes; Max wattage tested: 627; Power factor tested: 0.97; Efficiency rating (advertised): 90%; Fan(s): 135mm; PCI-E: 4 (6+2-pin); Main 12V: 20+4-pin; 8-pin EPS 12V: 1 (4+4-pin); SATA: 9; 4-pin Molex: 3; Floppy: 1; Warranty: 5 years

Test System Specs: Processor: Intel Core i7-3770K; Motherboard: GIGABYTE GA-Z77X-UP4 TH; GPU: ZOTAC GeForce GTX 580 (2x, SLI); Storage: Crucial Real SSD C300 128GB; OS: Windows 7 Enterprise (64-bit)

State-Of-The-Art Standards

GDDR5

In general computing, the memory bandwidth of your PC has a big impact on your ability to multitask and move and edit files. In gaming applications however, memory bandwidth plays a much more pivotal role, impacting the graphics adapter's peak playable resolution, texture quality, and pixel rendering capabilities. When reviewing graphics cards, we've often highlighted the direct relationship between your screen resolution and a game's best playable frame rate. One of the core factors that helps determine just how high you can jack your resolution up without killing your frame rates is the size and speed of the GPU's frame buffer. In short, the faster and larger (in that order) the frame buffer, the better your gaming experience is likely to be. Gaming enthusiasts can really never have too much memory bandwidth.

In this month's "State-Of-The-Art Standards," we're covering the fastest available memory that currently ships with most modern graphics adapters and at least one of the next-generation game consoles coming out later this year: GDDR5, or Graphics Double Data Rate, version 5. Read on for a brief overview of the technology, some historical context, and a look at what's on the horizon for the GDDR standard.

What Is GDDR5?

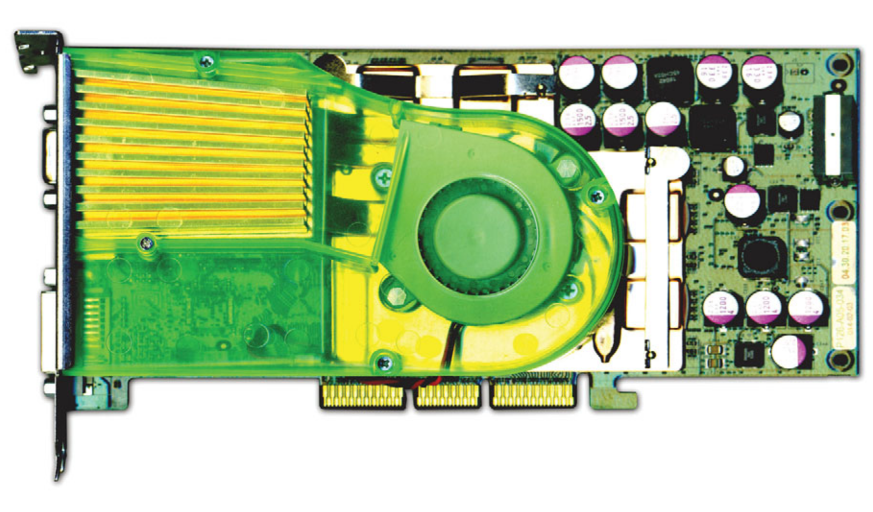
GDDR5 is a high-performance dynamic random-access memory standard that is designed specifically to handle the high bandwidth demands of graphics adapter workloads. GDDR5 supports data rates up to four times faster than that of the previous-generation standard, GDDR4, which significantly improves the bandwidth delivered to the GPU over a narrower memory interface. GDDR5 is based on the DDR3 memory specification.

Technology Trifecta

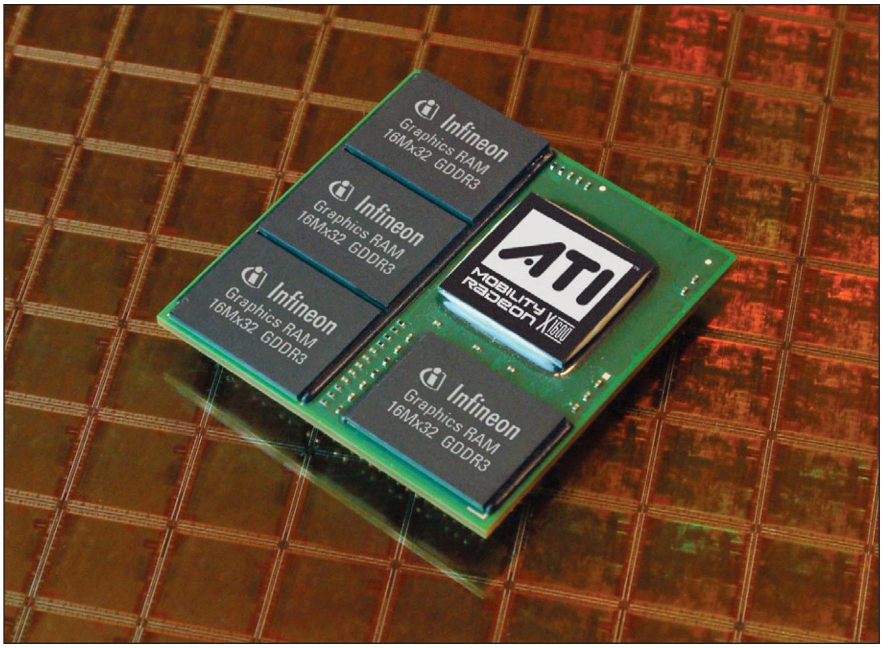
There are three features that make GDDR5 stand apart from the DDR system memory upon which it is based. These features are designed to increase performance in graphics-heavy workloads, stabilize these workloads, and keep the cost of implementing the memory into graphics cards and devices as low as possible.

The first feature is called data eye optimization, which refers to the memory standard's data and address bit inversion, which reduces both the number of zeros that are transmitted and the supply noise-induced jitter on the data lines to improve signal quality and slash power dissipation. It also references GDDR5's adjustable driver strengths, voltages, and terminations, which combine to enable faster interface tweaking, relaxed transmission lines, and ultimately cheaper PCBs.

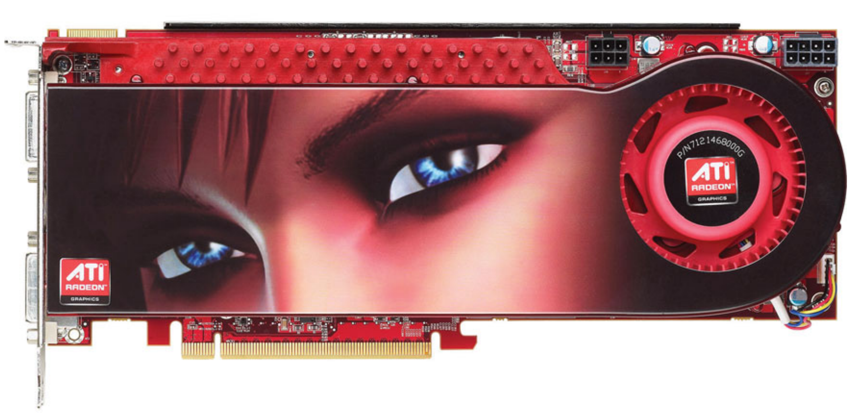
GDDR5 also brings with it a new adaptive interface timing, which lets



The GeForce FX 5800 Ultra was noisy and hot, thanks in no small part to GDDR2.



Infineon Technologies spun off its memory division in 2006 as Qimonda.



The vanilla Radeon HD 3870 used GDDR4, but due to supply constraints ATI opted to use GDDR3 for its Radeon HD 3870 X2.

GPU makers and their add-in board partners vary the lengths of traces, which in turn saves on the cost of components and simplifies PCB layout and design. The new timings also improve stability of the memory subsystem.

Another stability-aiding feature comes in the form of GDDR5's improved error detection mechanisms, which enable read and write error sensing and real-time error detection, the latter of which lets the system resend the data before you know anything's gone awry.

GDDR's Confusing History

Prior to 2004, graphics cards from ATI, NVIDIA, and others used the same RAM onboard as we plug into the DIMM slots on motherboards. But as graphics workloads grew more demanding, this general-purpose memory became increasingly too slow and power hungry to adequately suit GPU makers' needs.

In January 2003, NVIDIA launched the GeForce FX 5800 graphics card and equipped it with DDR2 memory. Despite the label, the GeForce FX 5800 didn't use the same DDR2 as we began using in PCs a year later; it was a modified version of DDR. Specifically, this preliminary DDR2 memory, sometimes referred to as GDDR2, lacked DDR2's double I/O clock rate (compared to DDR) and came with DDR's 2.5-volt operating voltage. You may also recall that the GeForce FX 5800 was a notoriously noisy card, prone to overheating, and the memory subsystem's power demands helped earn that card its reputation.

Enter ATI Technologies, which together with the JEDEC Solid State Technology Association designed a new graphics-specific memory standard based on the polished version of DDR2 (also a JEDEC standard). This memory technology, called GDDR3, was able to achieve a 1.8-volt operating voltage thanks to its manufacturing node shrink and the lower internal clock rate. Besides improving power consumption, the lower voltages also eased load temperatures. Manufacturers using GDDR3 memory are able to increase the clock speed and use more precise timings thanks to the improved thermal envelope.

Another unique feature of GDDR3 compared to DDR2 includes its ability to better handle certain graphics workloads. GDDR3 features a unidirectional and single-ended strobe signal. As a result, graphics cards using

GDDR3 get a separate read and write data strobe, which in turn translates to a vastly improved read to write ratio compared to DDR2. GDDR3 also includes a hardware reset capability, which lets it flush the memory and retry the operation.

GDDR3 memory is capable of increasing data rates by transferring 4 bits of data per pin in two clock cycles. Despite ATI's work on the standard, NVIDIA was again the first graphics card manufacturer to release a card that used the graphics-specific memory standard. A version of the GeForce FX 5700 Ultra that used GDDR3 memory came out in early 2004, and its superiority to GDDR2 was obvious from the outset. NVIDIA's next family of graphics cards debuted with GDDR3 on the highest-end parts, namely the GeForce 6800 Ultra. ATI's competing Radeon X800 XT and X850 XT graphics cards also launched shortly thereafter equipped with GDDR3 under the hood.

Qimonda was the first memory maker to announce GDDR5 chips.

Not much later, GDDR3 began showing up in places other than in graphics cards; it was used in Sony's PlayStation 3, Microsoft's Xbox 360, and Nintendo's Wii. Even today, GDDR3 is still the most common type of memory to appear in entry-level graphics cards. NVIDIA went on to rely predominantly on GDDR3 in both the GeForce 7000 and 8000 series graphics cards. ATI used GDDR3 for the majority of its Radeon X1000 series as well as it Radeon HD 2000 series. Both manufacturers relegated DDR and DDR2 to use only in entry-level models.

JEDEC outlined the specification, but it was Samsung that was out first with samples of what was supposed to become GDDR3's replacement, GDDR4. In October 2005, Samsung announced plans to manufacture GDDR4 SDRAM capable of running at 2.8Gbps per pin, and later said graphics cards using the new memory standard (based on DDR3) would become available in 2007. This time it was ATI that came out with graphics cards that used the new standard first. Variants of the Radeon X1950 XTX, Radeon HD 2900 XT, 2600 XT video cards all used GDDR4 memory. NVIDIA initially had plans to use GDDR4, but later scrapped them. GDDR4 only showed incremental improvements compared to GDDR3, and to make matters worse, the next revision of the memory standard was already gaining momentum.

In November 2007, the Dresden, Germany-based DRAM manufacturer Qimonda began sampling its first batch of 70nm GDDR5 memory silicon, in 512MB chips clocked at 4.5GHz. The company had decided to skip GDDR4, and as a result hastened its work on the follow-up (also based on DDR3). GDDR5 chips support a per-pin data rate of 5Gbps, or up to 20GBps for the chip. For perspective, a GDDR5 device can read four DVDs (at 4.7GB each) in less than a second. Later advancements

> In November 2007, the Dresden, Germany-based DRAM manufacturer Qimonda began sampling its first batch of 70nm GDDR5 memory . . . .

The GeForce GTX 480 was the first of NVIDIA's cards to adopt GDDR5.

enabled manufacturers to achieve up to 6Gbps per pin data rates and better. At the time of GDDR5's announcement, GDDR4 memory was still fairly new, having achieved data rates up to 16GBps.

One of the most necessary features of a graphics-specific memory standard is low-power demands. GDDR5 operates on 1.5V, similar to that of GDDR4. The difference here is that the successor standard is capable of slashing power consumption by slowing down unused memory.

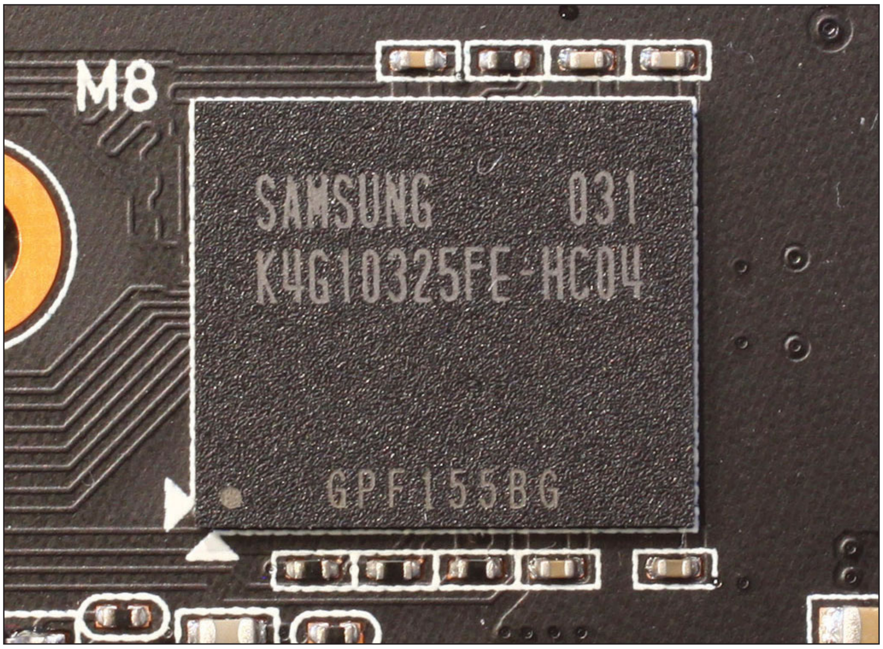
Shortly after Qimonda's announcement, another memory maker, Korea-based Hynix, announced that it would be offering 1GB GDDR5 chips, manufactured on a 66nm process, and capable of the same 20GBps data rate as Qimonda's 512MB part. In December of 2007, Samsung announced that it would be offering a 6Gbps per pin GDDR5 chip starting in early 2008. Samsung's variant would be manufactured using a 60nm process. According to Hynix, GDDR5 would become common toward the middle of 2010.

Much earlier than that, in 2008, AMD (having recently completed its acquisition of ATI Technologies) launched its Radeon HD 4870 graphics card. The firm used Qimonda's 512Mb GDDR5 modules running at 3.6Gbps. NVIDIA's first major rollout of GDDR5-based graphics cards didn't occur until the GeForce GTX 400 series, which launched in 2010.

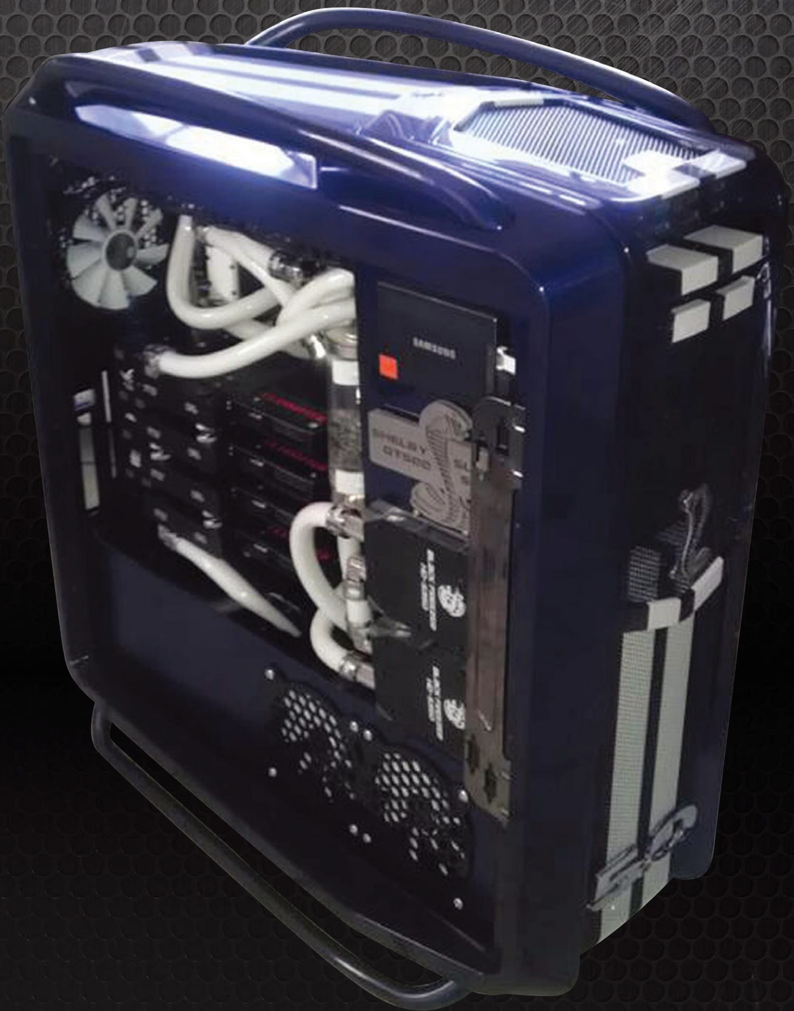
The PlayStation 4's specs were announced in February of this year, and according to Sony, the game console will come with 8GB of GDDR5 memory. The Xbox One, announced in May of this year, will forgo GDDR5 in favor of 8GB of DDR3. With the Wii U, which launched in November 2012, Nintendo has also opted to fulfill the console's memory demands with DDR3 memory rather than the more graphics-specific standard.

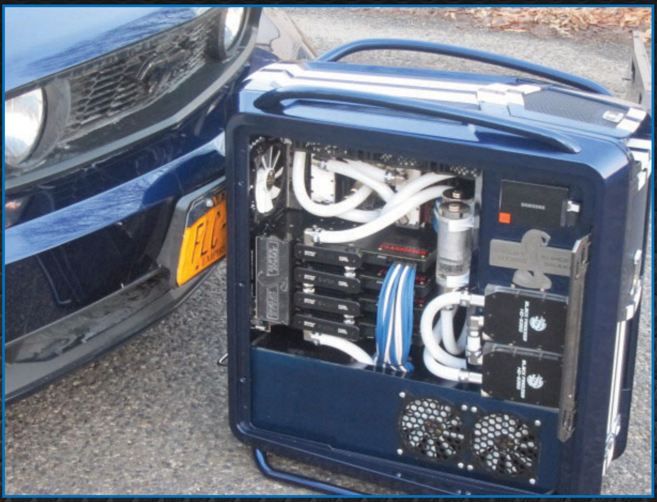
GDDR's Future

Given the hit-and-miss success of GDDR2, GDDR3, GDDR4, and GDDR5, you might expect the developer of the follow-up to the highly successful GDDR5 to take the cautious approach. And that's exactly what AMD is doing. GDDR6 is currently in the pipeline, and with the help of the JEDEC, the standard is currently scheduled for a 2014 launch. Interested parties include NVIDIA, Intel, Qualcomm, Texas Instruments, CISCO, and every computing enthusiast looking for richer and more immersive gaming experiences. ■



This Samsung-manufactured GDDR5 chip is attached to an NVIDIA GeForce GTX 560 Ti.


SAMSUNG
SHELBY GT500



Mustang Super Cobra GT

Otis “ReckNBall” Fatz won *CPU*’s Mad Reader Mod contest late last year with his Plum Crazy Trooper, which appeared on the cover and inside the September 2012 issue. Fatz has been busy in the interim, having spent nearly four months’ time on this month’s winner, the Mustang Super Cobra GT.

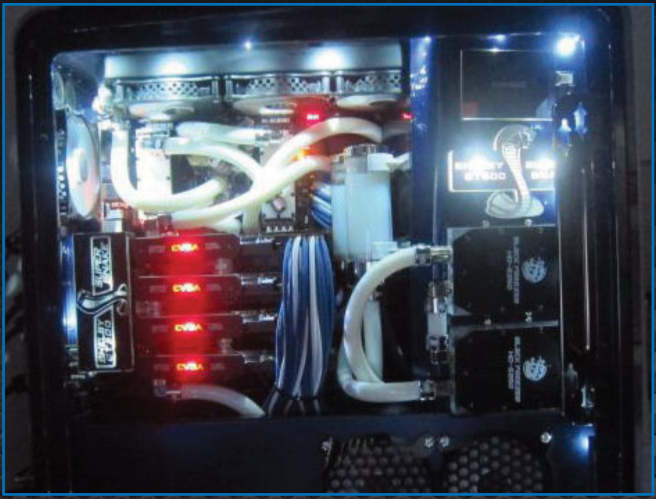
Like his previous winning mod (and as you can probably tell from its name), the Mustang Super Cobra GT is an automotive-themed mod built to embody the power and speed of modern muscle cars. Fatz runs his own modding business out of his home and built the MSCG for a client who has his own Mustang. This client requested a PC that a) ties into the look of his pony car, b) provides the best gaming performance available today, and c) spends its off hours serving up crazy FLOPS in conjunction with his home folding club.

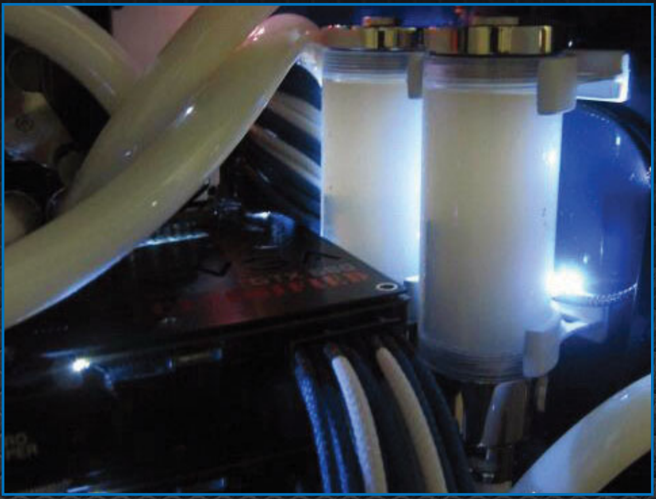
High-Performance Parts

The Mustang Super Cobra GT neatly ticks all those boxes and then some, starting with its automotive-grade paint, racing stripes, and GT500 badging. Gaming performance is a given, as well, thanks to Intel’s Core i7-3930K, an ASUS Rampage IV Extreme X79 mobo, 32GB of Corsair Dominator Platinum DDR3-1866, and no fewer than four EVGA GeForce GTX 680 Classified graphics cards. Storage is handled by a pair of Seagate 3TB Barracuda XT hard drives and a 256GB Samsung 830 Series SSD; removable storage comes via an LG Black Internal 12X Super Multi Blue. An ASUS Xonar Essence STX belts out the audio, and all of this gear is powered by an EVGA SuperNOVA NEX1500 PSU and lovingly packed into a Cooler Master COSMOS II.

Keep It Cool

The MSCG’s cooling subsystem is equally impressive. It begins with a quartet of EVGA Classified Hydro Copper waterblocks and backplates, three Koolance radiators (two 240mm units and a 420), and a Koolance CPU-370 waterblock. The Rampage IV Extreme’s chipset is cooled by EK-FB Kit RE4 Nickel + Acetal CSQ water blocks, while the memory and hard drives are cooled by Bitspower parts: Universal RAM Modules for all four banks of memory, and a Bitspower HDD Acetal Liquid Cooling Block, respectively. Fatz tied it all together with Masterkleer PVC tubing in UV





reactive white and Performance-PCs.com's Dual Uber 655 Fully Modded D5 pump.

Body Work

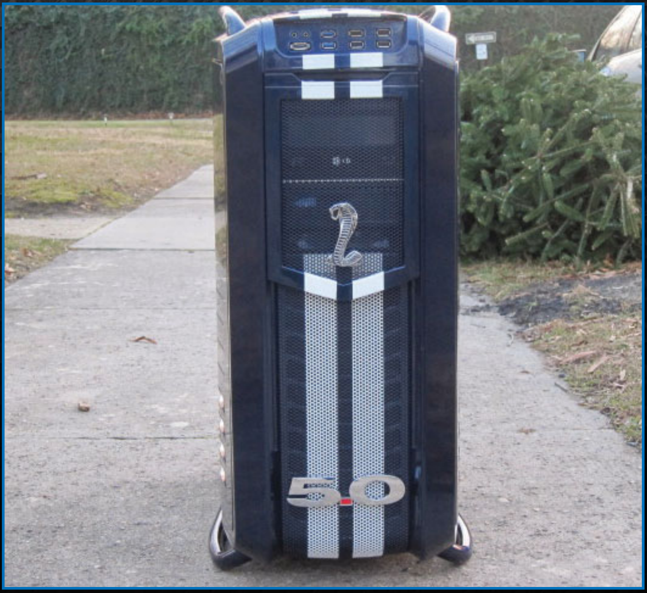
Fatz had to make considerable alterations even to the roomy COSMOS II's interior to get all this stuff to fit. In addition, he reworked the front and top panel's mesh insets, ordered some Mustang badges from a speed shop in Pennsylvania and had two more made to order (the backlit Shelby GT500 Super Snake panels).

Once the physical structure of the case met Fatz's approval, he sent it to custom car painter Kevin Focht, who gave the Mustang Super Cobra GT its immaculate dark blue finish and vertical racing stripes. Then it was time to install the hardware and complete the finishing touches, including adding the aforementioned badges.

And speaking of badges, Fatz made sure to point out that whereas on most Mustangs a "5.0" badge indicates the presence of a 5-liter V8, on the Mustang Super Cobra GT it stands for 5.0GHz, which is of course the CPU overclock. That's a pretty nice bump from the Core i7-3930K's stock 3.2GHz clock speed.

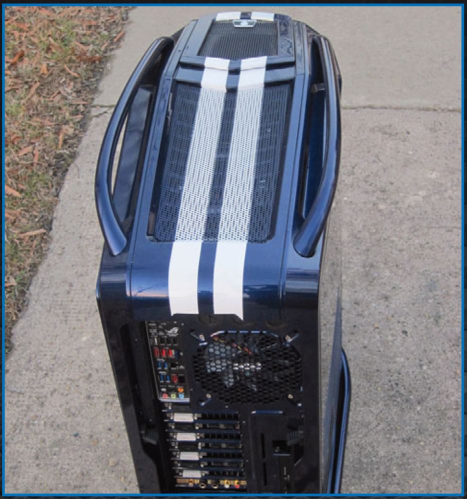
We Got Next

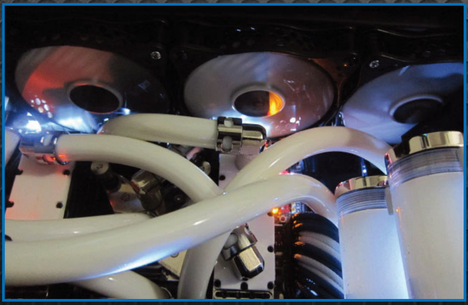
We asked Fatz if he has started work on another mod yet, and his answer was encouraging: "I have a few I'm trying to finish now and a few more on my drafting table." ■

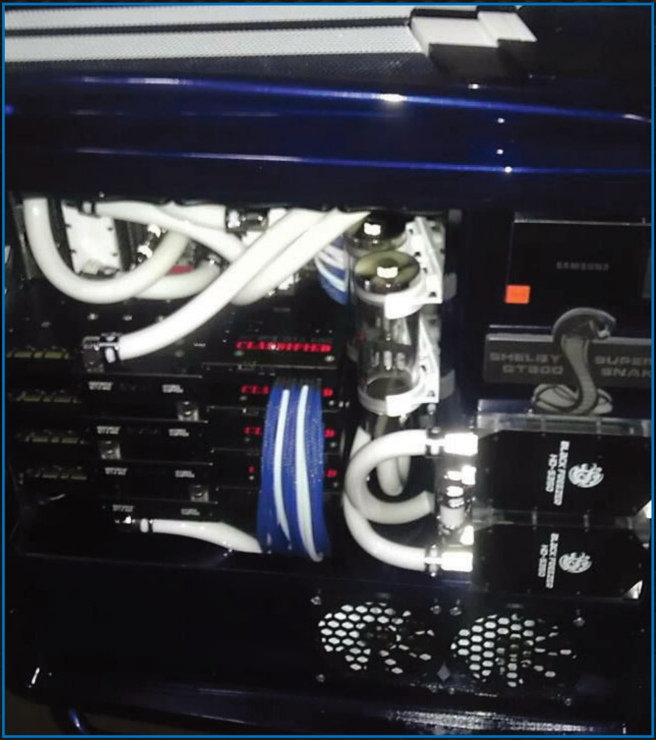


Give Us Your Mod

Have a computer mod that will bring tears to our eyes? Email photos and a description to madreadermod@cpumag.com. If we include your system in our "Mad Reader Mod" section, we'll send you $1,500 and a one-year subscription to *CPU*. (U.S. residents only.)



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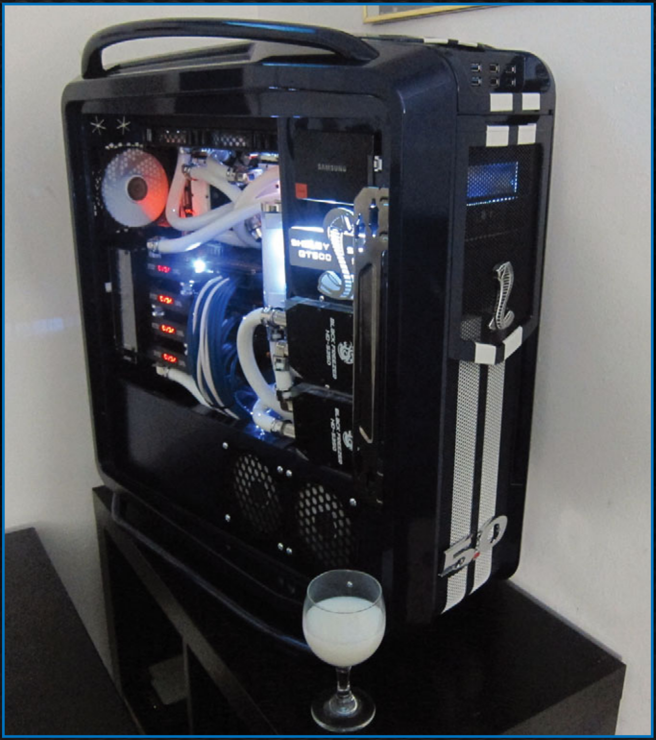
SHELBY GT500
SUPER SNAKE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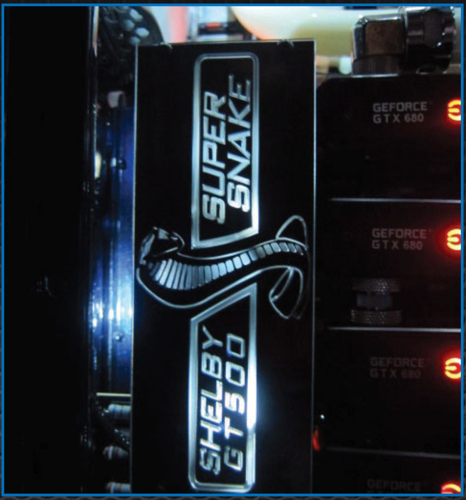
SUPER SNAKE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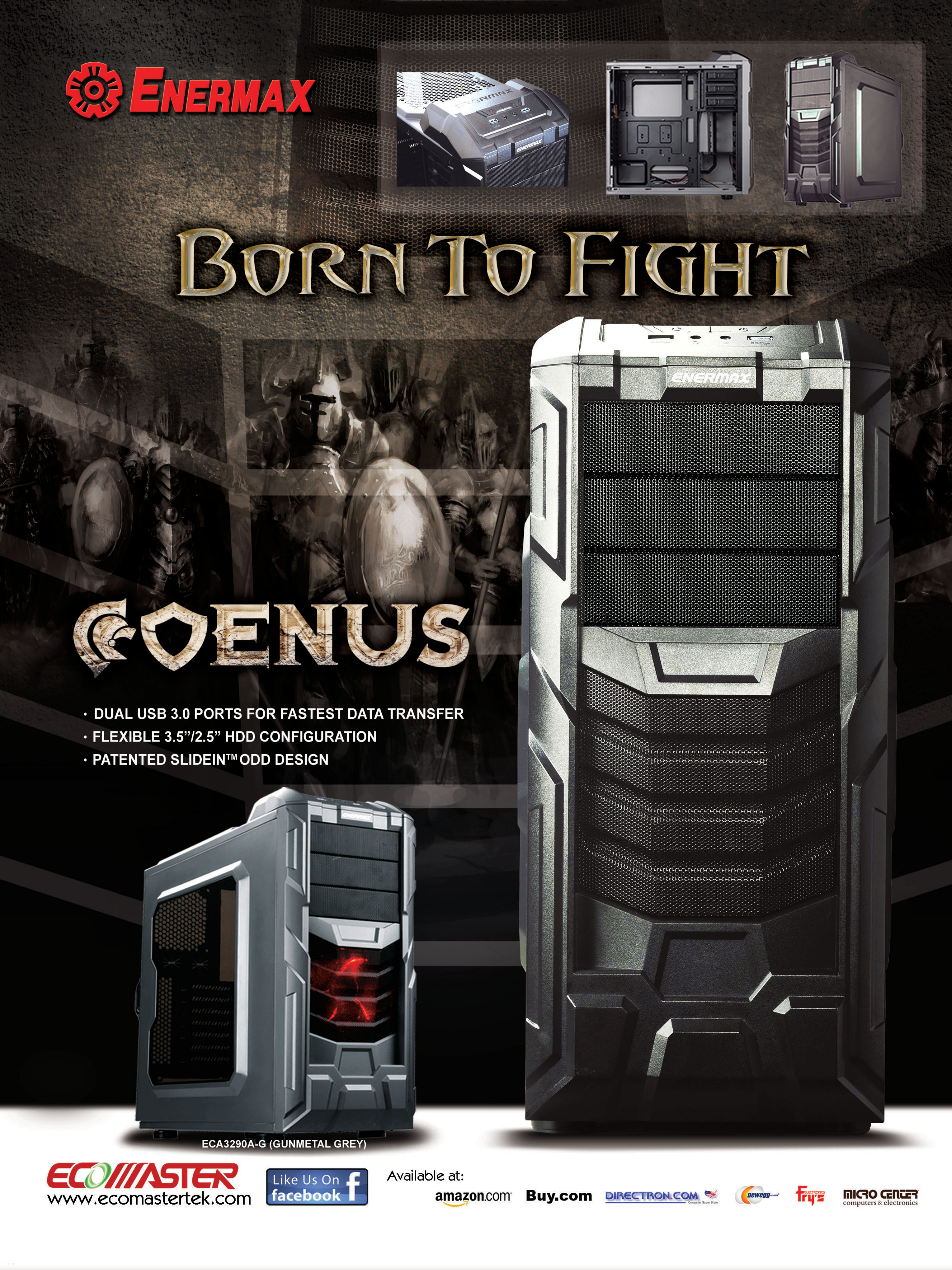

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Modding Masters

Take Command Of Your Custom Cooling

Every month, *CPU*'s "Mad Reader Mod" showcases an unbelievable, jaw-dropping custom mod that redefines what we thought was possible with the right tools in the hands of an inspired, creative, and determined modder. These are the systems that turn heads and win prizes at LAN parties, and the modders behind them are the rock stars of the PC enthusiast scene. Many of these modders are commissioned to create custom mods for the biggest companies in the business, but a lot of them got their start with little more than an idea and a clunker case in need of a visual refresh.

What if you're just beginning your modding career? "Mad Reader Mod" shows you the end result, but if you've ever followed a worklog online you know the insane amount of work that goes into these stunning creations. Sure, worklogs help explain much of the magic behind the mods, but wouldn't it be great to have a sit-down chat with the sages of modding, who have collectively amassed thousands upon thousands of hours of experience?

"Modding Masters" provides you with up-close and personal access to the pillars of the modding community. We've called on previous "Mad Reader Mod" winners as well as modders who have taken first-place honors at our LAN party case mod contests to provide their expert opinion on all things mod. It's the closest you're going to get to these rotary tool ninjas and paint booth Picassos short of online videoconferencing or criminal trespass. Listen to their wisdom, learn from their mistakes, and follow their advice, and perhaps the coveted "Mad Reader Mod" spread will one day belong to you.

Hopefully you're ready to do more work under the hood of your hot rod mod, "Great watercooling systems look deceivingly easy, logical, and effortless." -Khowdee

because this month we're diving back in with another big project—cooling. The, er, cool thing about cooling is that it's not only an opportunity to make a bold artistic statement but also the single biggest factor in determining a PC's overclocking potential. So, no matter your reason for modding, cooling is something you have to do right.

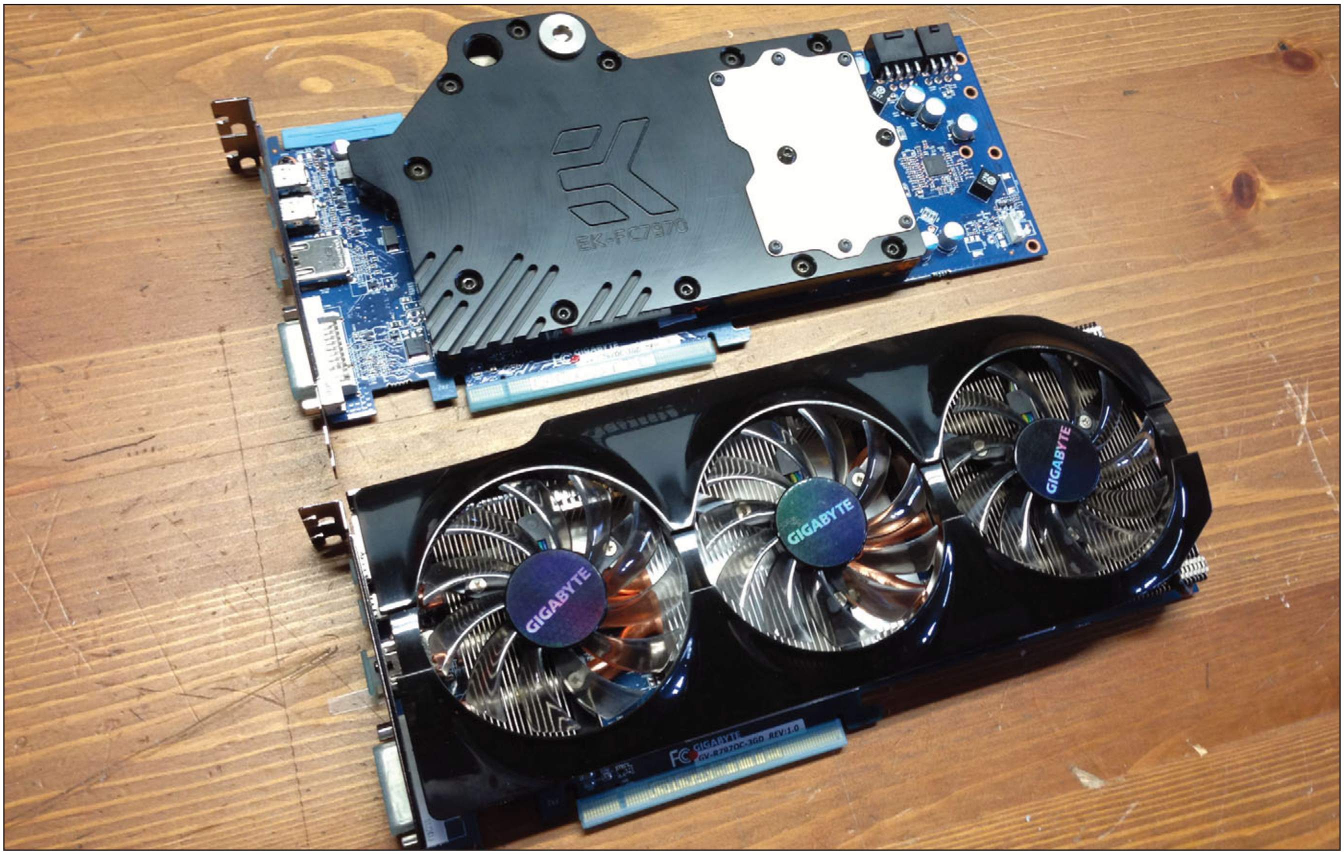
We have three veterans joining us this month who collectively have enough plumbing experience to rival Pipefitter's Local 1337. They've worked with countless waterblocks, reigned in ridiculously large radiators, and tackled a whole lot of tubing. Jeremy "E.E.L. Ambiense" Birch, Richard "DarthBeavis" Surroz, and Ton "TiTON" Khowdee are back, and they want to help you trick out your cooling loop. Stay a while and see what they have to say; we're confident that you'll learn a thing or 10.

Cool But Complicated

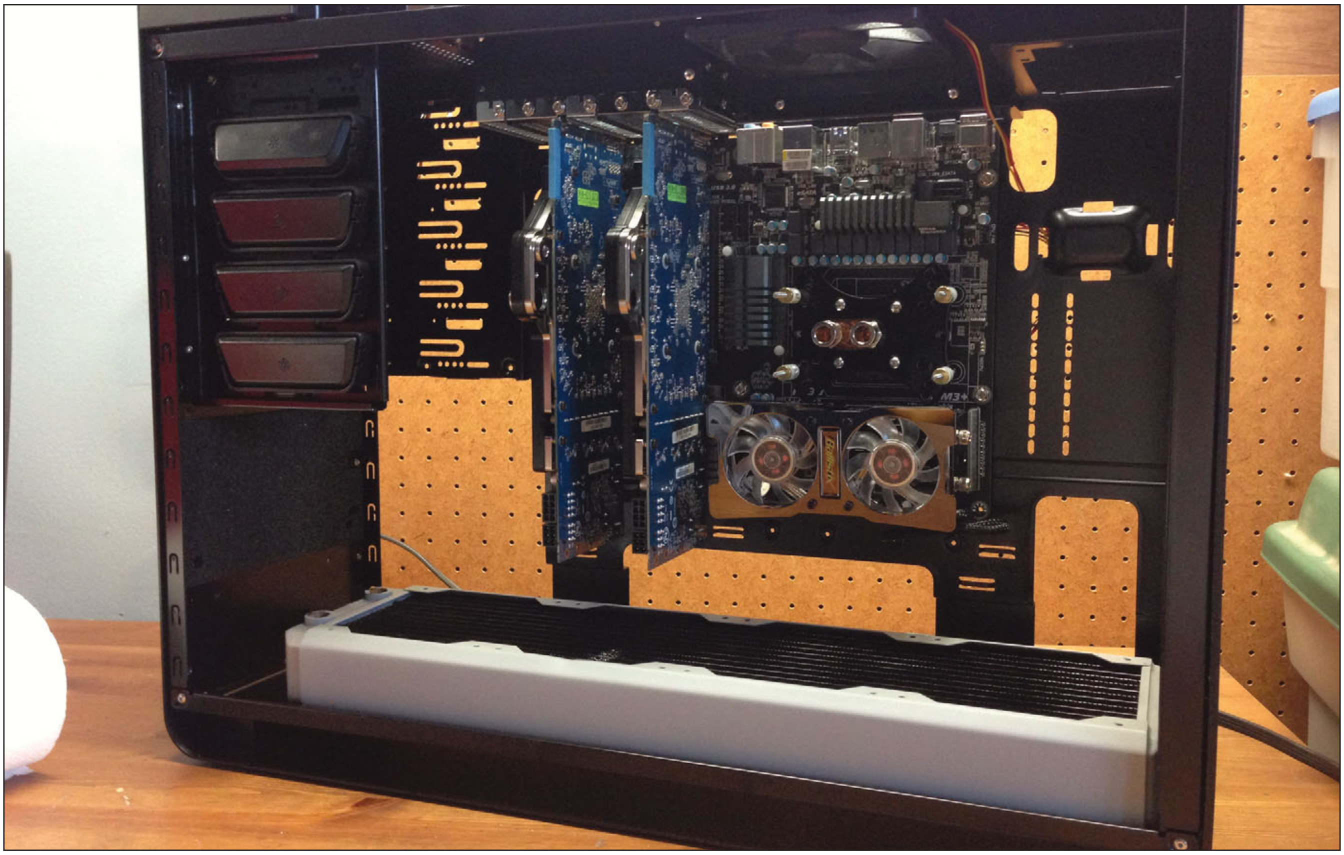
Have you ever strolled through a LAN party, eyeing all the mods, and thought to yourself, "That doesn't look so hard. Bolt down a waterblock and radiator, set up a pump and reservoir, and run some tubing."? Custom liquid-cooling setups might look easy, but they're anything but, according to our Masters.

"Great watercooling systems look deceivingly easy, logical, and effortless," Khowdee says. "The cleaner and well-put-together a watercooling system looks, the more blood, sweat, and tears are put in by the modder."

Birch agrees. "Honestly, the fact that [a watercooling loop] ends up looking clean is the major hurdle when installing one. The previously touched-on subject of planning really comes into play here. Asking yourself questions such as, 'What do I want to cool, and how?' comes to mind. When you go into a project without any kind of planning, you better know



Aftermarket graphics cards often use a PCB design that's different from AMD's or NVIDIA's reference design. If you're going to liquid-cool a graphics card, make sure the block you buy will be able to adequately cool all of the card's components.



As you can see, radiators can take up a significant amount of space in your case. Try to plan for this as early as possible.

what you're doing or it can end up in tragedy." Birch is quick to point out that these tragedies are usually expensive, too.

"Tubing management is just as complicated as wire management," Surroz says, "but actually planning the plumbing is more critical in that a badly designed loop can kill your cooling performance. There definitely is a balancing point between performance and aesthetics, although the large variety of specialty products on the market today means a person using a la carte components can truly have it all."

Khowdee says that he's seen a lot of rookies approach liquid-cooling as though simply installing the necessary components is all it takes. "Designing a loop is an art. Many beginning modders believe that watercooling is the magic heat-killing bullet: If they install a custom loop, the temperature of their system will automatically drop. Well, if the system is designed and sized properly, there will be great cooling and temperature. If the system isn't sized properly, they can actually be [negatively] impacting the temperature of all other devices in the loop. By adding an additional block, extra heat load is now placed on the loop. If there is not enough cooling, the radiator cannot displace all the heat in the coolant."

Look Before Your Loop

Khowdee wants new modders who can't wait to install a custom cooling to loop to keep in mind a few realities. "Newcomers to liquid-cooling see all the great benefits, but they also need to be aware of the potential headaches."

As Khowdee mentions, simply installing custom liquid-cooling doesn't guarantee anything other than upping your bill by a few hundred bucks. In fact, if you don't know what you're doing the end result could be worse

> "Tubing management is just as complicated as wire management." -Surroz

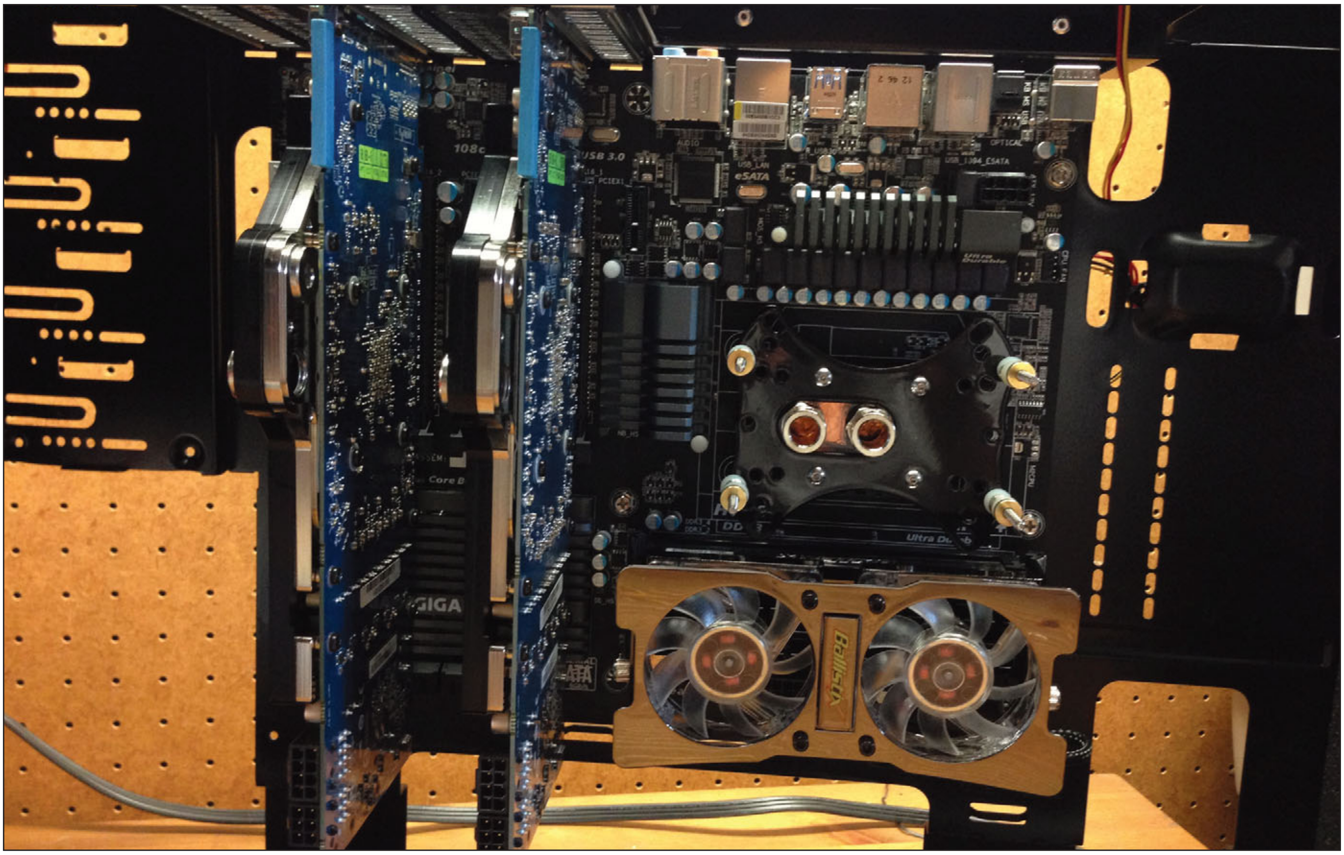
> "Even if you get the exact-same video cards from the same manufacturer, it doesn't guarantee the cards will be the same." -Khowdee

than sticking with your hardware's stock cooling. "If you have too many blocks and a radiator that's not large enough, temperatures can be the same as stock cooling or warmer," he says.

The same holds true for acoustics. Liquid-cooling supporters tout it as quieter option than air cooling, but a bad loop can be noisy, too. Khowdee says that overtaxed pumps and fans are the most offensive culprits.

If you want to cool your mod's video card(s), be prepared to do your homework. Unlike cooling your CPU, a video card has a bunch of other components in addition to the GPU (memory chips, VRM, and MOSFETs) that require cooling. Khowdee recommends going with full-coverage waterblocks if you plan to include your graphics card in your mod's loop.

Also, be aware when AMD's and NVIDIA's board partners make changes to the companies' reference design. "Some manufacturers design custom PCBs to optimize the performance of the card and to differentiate it from the other vendors' offerings," Khowdee says. "The challenge with a non-reference design is that the reference waterblock may not fit properly. Even if you get the exact-same video cards from the same manufacturer, it doesn't guarantee the cards will be the same. Even with the same part number, there may be



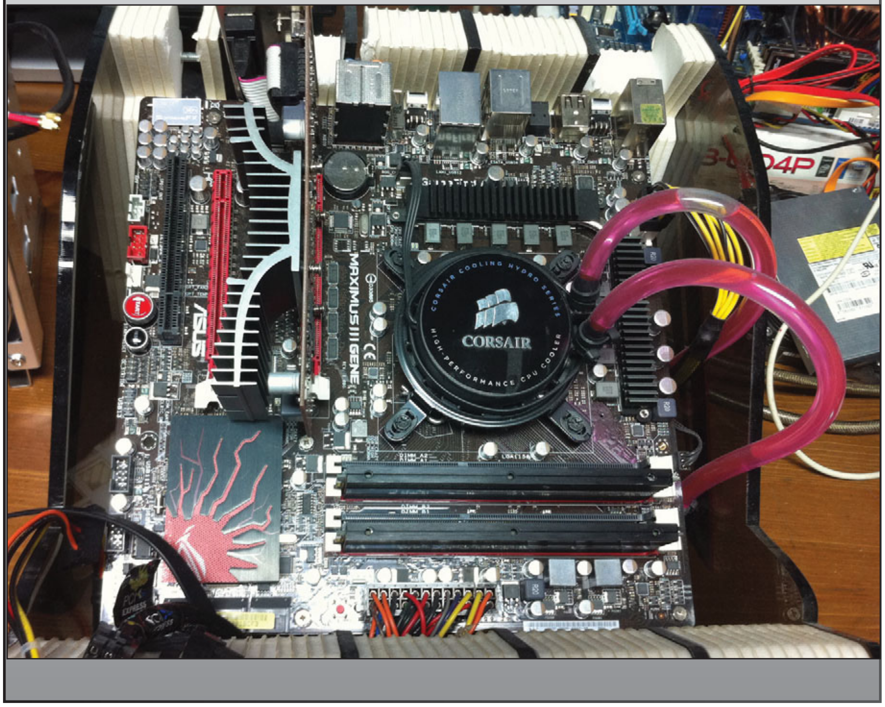
Our Masters recommend dry-fitting all the components of your loop so you know precisely how much tubing to cut. It will save time in the long run and result in fewer costly mistakes.

Closed-Loop Doesn't Mean Hands-Off

Once you start putting together a custom liquid loop on paper and you run the numbers, it's clear that building your own watercooling system piece by piece is an expensive proposition. Getting a closed-loop liquid-cooler from one of any number of manufacturers instead is a more affordable alternative.

The downside to taking this route is that you lose the ability to distinguish your mod from other systems that use these CPU coolers. Or do you? Ton "TiTON" Khowdee says that with a little creativity, you can mod a closed-loop cooler with relative ease. For example, he's replaced the black tubing with clear tubing and then filled it with colored coolant. "This gave me the additional visual pop I was looking for, and helps tie it into the case mod," he says.

Another option is to paint the radiator and/or pump unit to match your mod's theme. Khowdee also replaces the cooler's stock fan with a high-performance, quiet fan, and he tries to use to this as another opportunity to give his mod a unified look. "This help makes the closed-loop cooler look like it belongs in the case, rather than an afterthought."



revisions. Modders need to be aware of the possible challenges."

Case Scene Investigation

All of our Masters stressed the importance your case plays in determining how you configure and execute your cooling loop. That includes the parts of the case that were designed for liquid-cooling components (such as space for a radiator), but it also includes parts that you can repurpose, such as the internal drive bays.

Birch explains, "I always choose a case based on layout, features, and how much of the stock stuff inside can I gut and make my own. For example, I'm not a ton-of-HDDs kind of guy, so the first to go is the HDD rack(s). I'm a 5.25-inch bay reservoir kind of guy, so I tend to use available bays for such things as I tend to modify and customize the outside of the case to feature the reservoir externally."

Surroz also evaluates a case based on how it can accommodate his cooling system (modding as necessary, of course).

"I take into consideration open drive bay areas for mounting a reservoir or reservoir/pump combination in that spot," Surroz says. "Mounting space for radiators is an obvious concern."

Khowdee often considers his primary components (CPU, graphics, memory, etc.) first, then selects a radiator that can handle their thermal output, and finally chooses a case that can hold everything. "Cooling has to be scaled and designed based on the components to be cooled," he says. "This will help determine the heat load that has to be dispersed and the size and number of radiators needed.

"After you determine what you need to cool, you can pick a radiator for the system. The radiator takes up the most space in a system, and having a case to accommodate the radiator is important. People like to incorporate the radiator inside the case for a clean, self-contained appearance. Some people prefer to place the radiator outside. A radiator outside the case can take in cooler air, and the hot exhaust will not impact the other components inside the case."

Parts Parade

In many ways, choosing the components for your liquid-cooling loop is like building a mini PC. There are a lot of pieces to this puzzle, and each system will require slightly different pieces. And, of course, because our experts are not computer-modding robots, all of them have slightly different opinions, preferences, and advice about their favorite cooling gear.

"I try to use the same brand for a consistent look," Surroz says. "Currently, my favorite brand is EK. They have a variety of tops for their blocks, ranging from the CSQ to clear. They also offer nickel-plated or plain copper bases. For fittings, I use Monsoon or the Performance-PCs' special edition Mod My Toys brand, which has carbon-fiber inlays. If I am doing hard lines, I use E22 push fittings, which come in a couple varieties and sizes. I also use E22's acrylic hard tubes. If I'm using regular tubing, PrimoChill offers the best color variety. For a reservoir, I often choose either an EK bay reservoir with a spinner to indicate flow or a Monsoon pump/reservoir combination."

Khowdee likes to consider the unsung heroes of a liquid-cooling loop, such as the radiator fans and reservoir. Radiator fans help the radiator do its job more effectively, naturally, and Khowdee recommends looking beyond a fan's raw output (cfm). "Fans should also be evaluated for their noise level," he says. "People usually choose large diameter fans for its ability to push out higher cfm at lower speeds."

Although it's not strictly necessary for a liquid-cooling setup, a reservoir offers a number of benefits, according to Khowdee. The ability to hold extra coolant is the most obvious, but reservoirs are also helpful because they can give you an at-a-glance indication of your coolant level. Reservoirs also let you quickly and easily add more coolant to your loop and bleed it as needed to remove air bubbles.

Birch knows what he wants in a radiator. "I'm a silence freak, so that tends to translate to large-core, low-fin-count rads designed to operate with minimal airflow (read: quiet fans). Thin radiators aren't my cup o' coolant. I tend to use large rads such as Coolgate's offerings, the Black Ice SR1 series from Hardware Labs, or even EK's XT/XTX series rads coupled with some low-spinning fans for quietness."

When the time comes to cut your tubing, a good, sharp pair of hose cutters is a must.

Your mod's cooling system is another opportunity to show off your artistic talent and present a cohesive theme. You can get tubing in a rainbow of colors and fittings with built-in LED lighting. The possibilities are virtually endless.

Birch also has a pair of pumps that he likes. "I tend to personally recommend the DDC for the size vs. the power you get out of it, but the D5 pump is more popular and more powerful and statistically more reliable, which is why everyone uses it. It's a bigger pump in comparison to the DDC, but they both perform very well for their class. Basically, what I'm saying is either of these pumps will work for you; it just depends on the project itself."

A Series Of Tubes

For our Masters, even tubing requires careful consideration. Tubing, after all, is just as important as every other part of the loop, so you shouldn't neglect it or make a hasty, haphazard purchasing decision. As far as dimensions are concerned, Surroz made up his mind years ago; he sticks with tubing that has a 3/8-inch inner diameter and a 5/8-inch outer diameter. "It gives the perfect balance of size to performance," he says.

My Mod In My Own Words: Jeremy “E.E.L. Ambiense” Birch

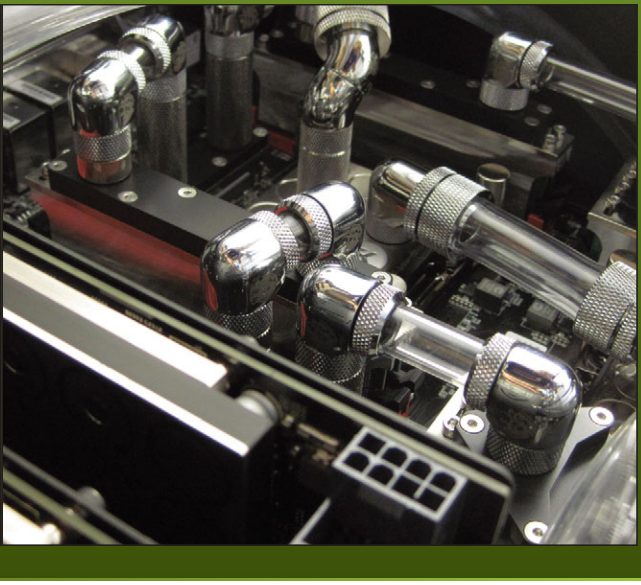
My recently published Project BIO-A10 mod is a great example, mostly because it’s still reasonably fresh in my mind.

I had a rough plan of attack mapped out for the build, but like any mod project there tended to be some unforeseen issues, no matter how minor, that crept up. I refer to them as “dynamic variables,” gremlins that try to sabotage the project. Sometimes, the issues tend to steer the project in a slightly different direction that ends up helping reach a set goal more efficiently or more intelligently, so it’s not necessarily a mistake. Like Bob Ross once said, ‘We don’t make mistakes, just happy little accidents.’

I recall needing to change back the top-mounted 120mm fan that was changed to a 140mm to increase airflow, but I didn’t have the client’s motherboard in hand yet. It turned out to be a P67 SABERTOOTH board which had high-profile MOSFET sinks on the top edge of the board; of course, they ran right into the 140mm fan. So I had to change the custom acrylic up top that housed the 140mm back to a 120mm.

By doing so, I ended up opening a small cavity right next to the now-smaller fan to allow a cathode inverter to be housed out of the way and unseen, and it ended up looking better in the long run anyway. Thankfully, I had no other issues that I can recall with that project. It was a rewarding and enjoyable experience. The watercooling install was straightforward and easy, but it tends to become second nature when you’re constantly doing it for your profession and over a period of years.

I have a current client build, Project Hubris, which has required some modification to the existing CaseLabs chassis to accommodate six customized EK reservoir/pump combos that I put together, along with six fill port solutions to allow easy maintenance for the client. It’s a dual-system build, with three loops per system. Due to clearance issues and complexity of the loops, it has become a combination of traditional tubing and some hardlining to minimize tubing running all over in front of the system’s components, mostly for aesthetics but also for cleanliness.



Although your waterblock and radiator will probably determine the inner diameter of your tubing, Khowdee explains how inner and outer diameter impact performance. With inner diameter, a smaller diameter allows for quicker flow, while a larger diameter provides greater flow. Tubing with a large outer diameter is less susceptible to kinking, but tubing with a smaller outer diameter is easier to run, especially in systems with cramped interiors and/or cooling loops with multiple blocks. If you decide to use compression fittings to secure your tubing to your barbs, then you have to take your tubing’s outside diameter into account when selecting your fittings.

“Personally, I’ve used every size out there, and they all have their benefits (and weaknesses),” Birch says. “It really just depends on the particular situation or project. I’m not going to use 1/2- to 3/4-inch (inside/outside diameter) tubing in a micro build, such as a HTPC project. Why give myself that kind of headache? I’ll look at 3/8- to 1/2-inch for easier tubing routing in the case, since space will be at a premium and performance loss from smaller tubing is negligible. If I’m building a big beast of a system, I’ll look at the larger tubing, such as 7/16- to 5/8-inch or 1/2- to 3/4-inch.”

Lately, a technique commonly called “hardlining” is gaining a lot of traction among the modding community. We won’t spill a lot of ink covering this topic, mostly because we think a beginning modder should probably get at least one mod under his belt using traditional tubing, but hardlining can produce a truly one-of-a-kind look if you’re up to the task. The technique gets its name from the use of hard acrylic tubing or copper pipe as your cooling loop's tubing—talk about real plumbing. These methods require additional tools in order to bend—literally—the acrylic or copper to your will.

"I follow E22's guide for bending acrylic, which includes using an NPR tube to prevent the acrylic tube from kinking," Surroz says. "For bending copper tubes, I use B Negative's guide which requires a pipe bender. (You can use an internal bending spring, as well.)"

Insider Tools

Over the years, Khowdee, Birch, and Surroz have learned their fair share of tricks. Although they refused to divulge all of their top-secret know-how, we managed to coax them into declassifying some of their intelligence.

Birch, for example, likes to include a few choice accessories. He'll add lighting and flow meters, "things of that sort can really add to feel of a project, even if I don't need them." Birch also likes to incorporate a G1/4 threaded port insert with an embedded temperature probe into his CPU waterblock, which lets him take temp readings using aftermarket software. "Think of it as garnish on a fine dish," he says.

"I try to be the King of Bling," Surroz says, "so I use tons of flashy items, including Monsoon Light Port angle fittings. These cool puppies actually allow you to put an LED into the fitting, which lights up the tubing. If I am doing a showcase build, I will use crazy coolant like Mayhems Aurora. Keep in mind this is only for a showcase build and requires a good flush of the system after the show."

Khowdee likes form and function in equal measure when it comes to tricking out his loop. "I personally like getting coolant that will coordinate with the overall look of the case mod," he says. "If you really want to show off the loop, get a coolant that is UV-reactive." He also likes to include a drain port in his loop. "In the event I need to drain my loop, I really don't want to flip by case mod upside down [and empty the loop through a fill port]. I typically put a drain port at the lower part of the loop. This does not impact the performance of the loop and will allow me to drain majority of the coolant without having to handle my case. After the loop is drained, the parts can be easily broken down for upgrades, replacements, or repairs."

Each Master also has a tool or two in his arsenal that he considers indispensable, uncommon among other modders, or both.

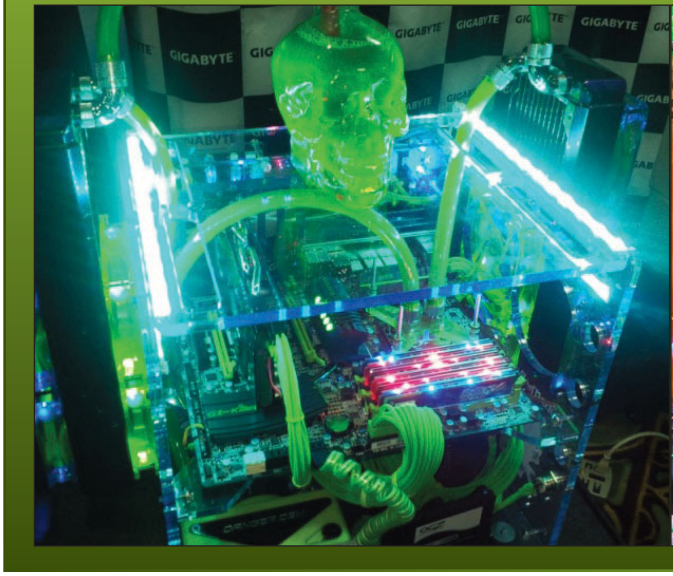
"One thing I use that others might not is a huge medical syringe for filling my loops," Surroz says.

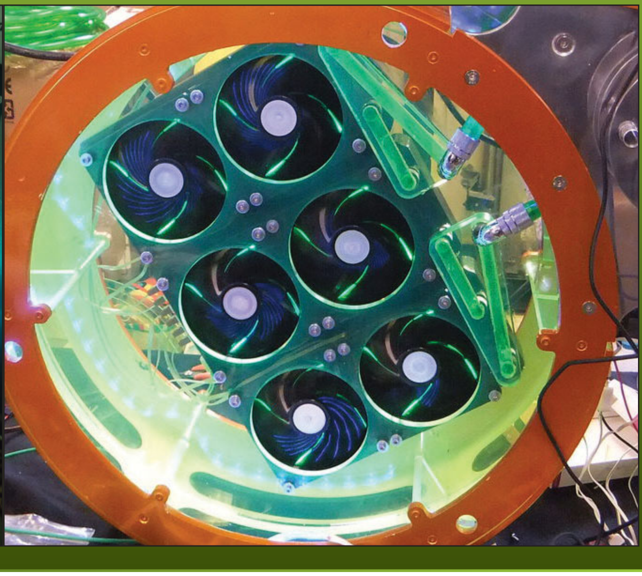
Khowdee uses an equally unique tool. "Maybe it's not easy to access the fill port or reservoir. A turkey baster can help put coolant in that hard-to-reach area." When his loop's fill port is easier to access, Khowdee uses a funnel to help ensure he pours coolant into the loop and not all over his rig.

Birch never leaves home without a pair of hose cutters, and he double-checks that its

My Mod In My Own Words: Richard "DarthBeavis" Surroz

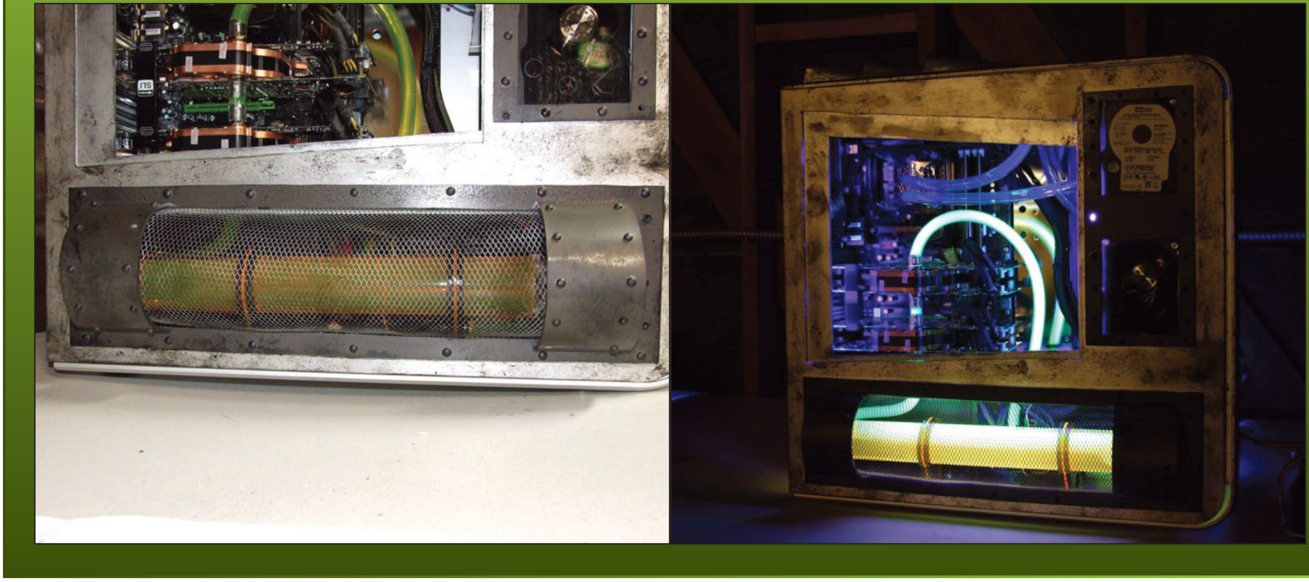
I have a couple interesting projects. One was the DarthBeavis Torture Rack. For that build, I converted a Crystal Head Vodka bottle into a reservoir. I needed a nice plug with tapped holes for screwing in the fittings, so Geno from Monsoon designed one for me that worked perfectly. Another cool project was the Duke Nukem PC. I wanted to attach multiple radiators into a manifold system. My buddy Geno again helped out by designing the pieces that I laminated into one single piece. The result allowed for one line in and one line out from the radiator "pod."





My Mod In My Own Words: Ton “TiTON” Khowdee

For the IRONMAN case mod, I wanted to go a different route. Instead of doing a single loop to cool the CPU and video cards, I went with two loops, each with its own radiator, pump, and reservoir. This allowed me to use a different color of coolant in each loop. This was only possible because I chose to use a large Silverstone TJ07 case, which illustrates the importance of case selection. I mounted a 240mm radiator on top of the case for the CPU, and a radiator on the bottom of the case for the video cards. It gave the case great visual and cooling impact.



blade is fresh and sharp before cutting any tubing, “otherwise, you’ll hate yourself.”

The Practice Run

Another issue our Modders agreed on was the need to test a cooling loop before it goes live, so to speak, and they actually recommend double-checking your setup at a couple of points during the installation. The first is prior to cutting any tubing.

“Dry-fit all the pieces, Khowdee says. “Mount the blocks on the devices and place them in the case, along with the radiator. This will allow for you to identify the best path to run the tubing, and identify any areas that there may be issues.”

Birch agrees, saying, “Always do a dry run with tubing; you can only cut it once. Figure out where you’re going to run things, and if you didn’t make an illustration ahead of time, laying out how the loop(s) are going to look, you can at least have some kind of game plan on the installation, so you don’t end up with a massive pile of 8-inch tubing pieces and needing 16-inch runs or something. The old adage ‘measure twice, cut once’ really works here.

“Always do a dry run with tubing; you can only cut it once.” -Birch

After he’s connected all of his tubing, Surroz makes sure to perform a leak test on his loop before actually turning his system on. You can and should do this without supplying and power to the motherboard, and this doubles as a way to circulate coolant through the loop before actually booting the PC.

Cold Finish, Bright Future

We’re not done making the inside of your mod pop just yet. With cabling and cooling out of the way, next month we’ll turn to one more “-ing”: lighting. With the countless hours you’ve put into your mod (or plan to), it would be a shame if all the best features end up obscured in the dark environs of a LAN party.

So, come back ready for more schooling in the August issue because yes, like every other topic we’ve covered in Modding Masters, proper lighting requires good planning and careful execution. There’s often a fine line between looking good and looking gaudy, and our Masters will help you tell one from the other. See you next month! ■

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Your First System Build, Part 2

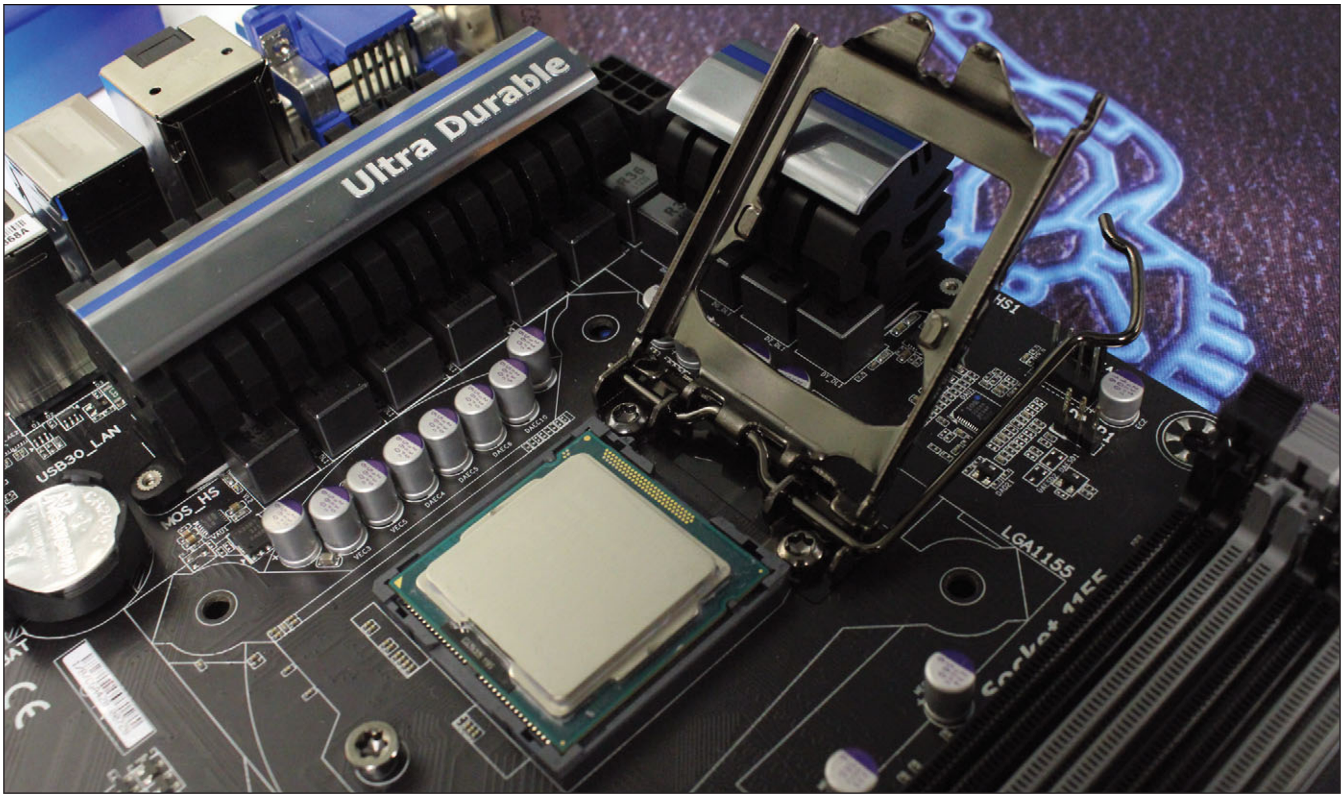
Some Assembly Required

Today is a big day for you. Greeting you when you return home after a hard day of work, or school, or work and school is an unassuming cardboard box with your name on it. It's the last component you ordered for your first system build, and it's finally here. The time has come for you to assemble your first rig, but as you stare at the small mountain of similar cardboard boxes, piled neatly on your floor, the mountain stares back at you. Where, and how, exactly do you start?

Undertaking your first build can be a daunting process, but rest assured that you're not the first enthusiast who's suffered from pre-build jitters. Even the most grizzled power users, those with scores of custom PC builds under their belts, were n00bs at one point. Plus, "Didn't install hardware correctly" isn't usually covered in a failed part's warranty, so that's reason to be a little nervous, too. Although you're not really gambling with your hard-earned money in the traditional sense, taking the DIY route to a new computer is fraught with risks that could cost you hundreds of dollars.

These are risks you don't have to face when buying a PC from a third party, but you're dedicated to building this one yourself. Facing the risks comes with the territory, and that's where we come in. Last month, we helped you select the right parts. This month, we help you put them together. At the end of this article, you should be able to press the power

You don't need Batman's utility belt to assemble your rig, but your toolkit shouldn't be limited to opposable thumbs, either.



Excessive force applies to processor installations, too. You shouldn't have to apply any pressure to your CPU to install it in its socket on your motherboard.

button on your case and watch your newly constructed machine roar to life.

Preflight Checklist

Before you start your first build, be prepared to set up shop for a while. Experienced builders can crank out a system in a matter of hours (or less, if they're not particular about perfectly routed cables and other finishing touches), but like most endeavors, rookies require more time. We're not suggesting a permanent workshop by any means, but we also wouldn't recommend spreading everything out across your dining room table with the idea that you can finish this project between meals.

The largest risk factor you face when unboxing your hardware, and to an extent during the build, is static electricity. Although we won't discount the very real possibility (and the very real damage) of a static electricity discharge affecting your exposed components, for as many systems as we've built over the years, we consider these dangers to be largely overblown. Sure, you may not want to shuffle across your '70s-era shag carpet wearing footie pajamas before beginning your build, but wearing an antistatic wristband isn't a necessity as long as you're careful, in our experience.

There are a few good practices that should reduce the risk of a static electricity discharge to almost nothing. First, skip the carpet if you can. Virtually any other surface—laminate, concrete, a plastic office chair mat—keeps static buildup to a minimum, so that's where we'd prefer to set up our table. Next, keep your components in their antistatic bags until you're ready to install them. Finally, you can discharge any static electricity on your person by touching any exposed metal on your PC case. Get into a habit of taking these very simple precautions, and electrostatic discharge should be little more than an afterthought.

As far as the rest of your work space is concerned, let common sense take the reins. Pick a room that doesn't look like it belongs on an episode of "Hoarders," and the bigger the table to spread out your components, the better. We prefer to work in a well-lit area and like having everything set up close to an electrical outlet.

You'd be surprised how useful a set of basic tools can be for building a PC, even if your case boasts an ample amount of tool-less features. For example, knurled thumbscrews are often tightly screwed in at the factory and require a screwdriver to remove (and conversely, tightening your case's assorted screws with a screwdriver ensures your components are secure). Further, we've yet to see a case that has a tool-less motherboard tray. Tweezers, pliers, and scissors all have their uses, too, and none of them are very expensive.

Once you've set up your work space and have your tools ready, all systems should be set to "Go," and you should be ready for takeoff.

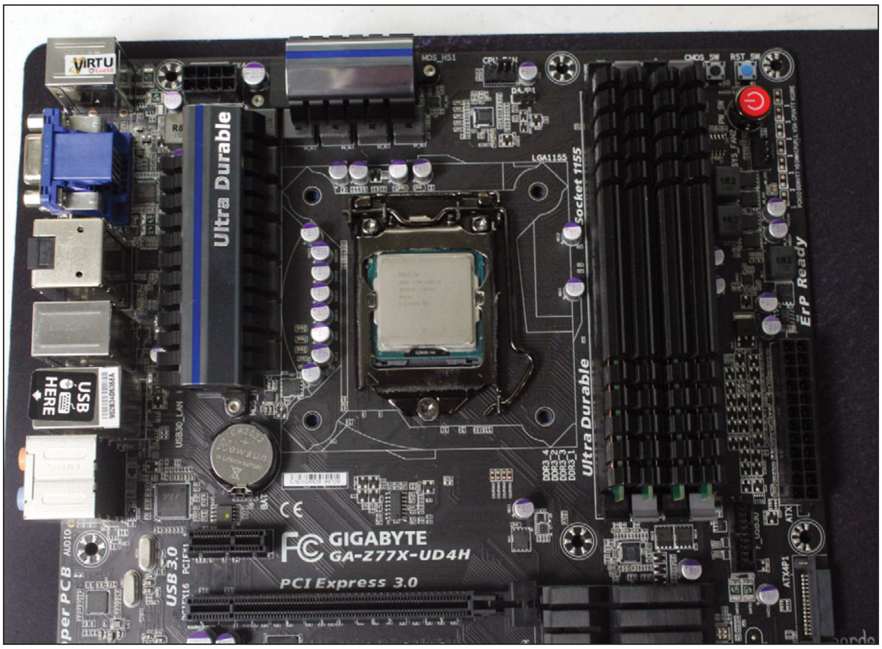
Install the rear I/O shield first, because your face and palm will meet and greet if you've installed all your components and then realize you forgot to install the rear I/O shield.

Prepare The Landing Pad

Consider the motherboard the cornerstone of your system. It's the component you'll install first in a traditional build, and there are a few quick things to check before dropping it into your case.

Make sure that your case's motherboard tray has the correct number of standoffs installed (easily identified by their brass hexagonal bodies), and that the configuration of standoffs matches your motherboard's form factor. Some case makers will preinstall motherboard standoffs, but just as many don't. In the latter situation, locate the standoffs in the small cardboard accessory box or plastic accessory bag included with your case. Remove as many as you need for your motherboard. Install them in your case's motherboard tray; we'll often use a pair of pliers to snug them up to the tray.

While you're doing this, take notice of the bundle of cables (power, reset, I/O, etc.) that's peeking out from one of the precut cable management holes inside your case. If you can, pull the bundle back through this hole so the cables are out of the way. We like to reroute these cables once we have a better idea of where we need to run our system's power and data cables.



We like to seat the processor and memory first before installing the motherboard in our case.

CPU Prep

OK, we lied. You probably won't install your motherboard in your case first. You'll probably install your processor in your motherboard first. Let's take a quick detour and raise a few points about installing a CPU.

For all intents and purposes, installing an Intel chip is the same as installing one from AMD. Today's motherboards use ZIF, or zero insertion force, processor sockets, which is fairly self-explanatory. In practical terms, though, you should never need to apply any pressure to a processor to install it in the motherboard's socket (as opposed to system memory or a graphics card, for example).

If you believe you've properly aligned your processor with your motherboard socket but the processor doesn't drop into the socket, don't try to force the processor unless you're fond of throwing money away. First, double-check the alignment; misaligning the processor is far and away the most common reason it won't drop into the socket. Failing that, recheck your motherboard and CPU for socket compatibility. If you bought a mismatched pair, start the return process for one and pick a match for the component you decide to keep. We won't tell anyone.

The only meaningful distinction between AMD's and Intel's processors during installation is that AMD's have a grid of pins on their underside. (Intel platforms locate the pins in the socket itself.) As a result, exercise a little more caution when handling AMD CPUs, because trying to find and straighten that one wayward bent pin has redefined frustration for countless power users.

Finally, if you scored an aftermarket cooler for your CPU, there's a good chance it has a mounting bracket that secures the base of the cooler to the exposed surface of the CPU. Mounting brackets like these affix to the back side of a motherboard, and they're a lot easier to attach before you install the motherboard into the case.

Now Boarding: Your Board

With your processor in place, let's get down to business and get that motherboard in your case. Your motherboard should include a thin metal rectangle with precut holes to match the motherboard's rear I/O ports; this is the rear I/O shield. You should see a corresponding rectangular cutout on your case's rear panel. Install the rear I/O shield first, because your face and palm will meet and greet if you've installed all your components and then realize you forgot to install the rear I/O shield.

Next, lay your case on its side and set your motherboard on the motherboard tray's standoffs. Your case's accessory box will have the necessary screws for fastening the motherboard to the standoffs. We generally like to install our memory modules at this point. Like your CPU, memory modules are designed to fit in a motherboard's DIMM slots one way, and one way only. Of course, it's easy to figure out which way is which by looking for the asymmetrical notch at the bottom of each stick. Line up each module and press them into place. The plastic tabs on either side of the DIMM slot should "click" into the notches on the sides of each module.

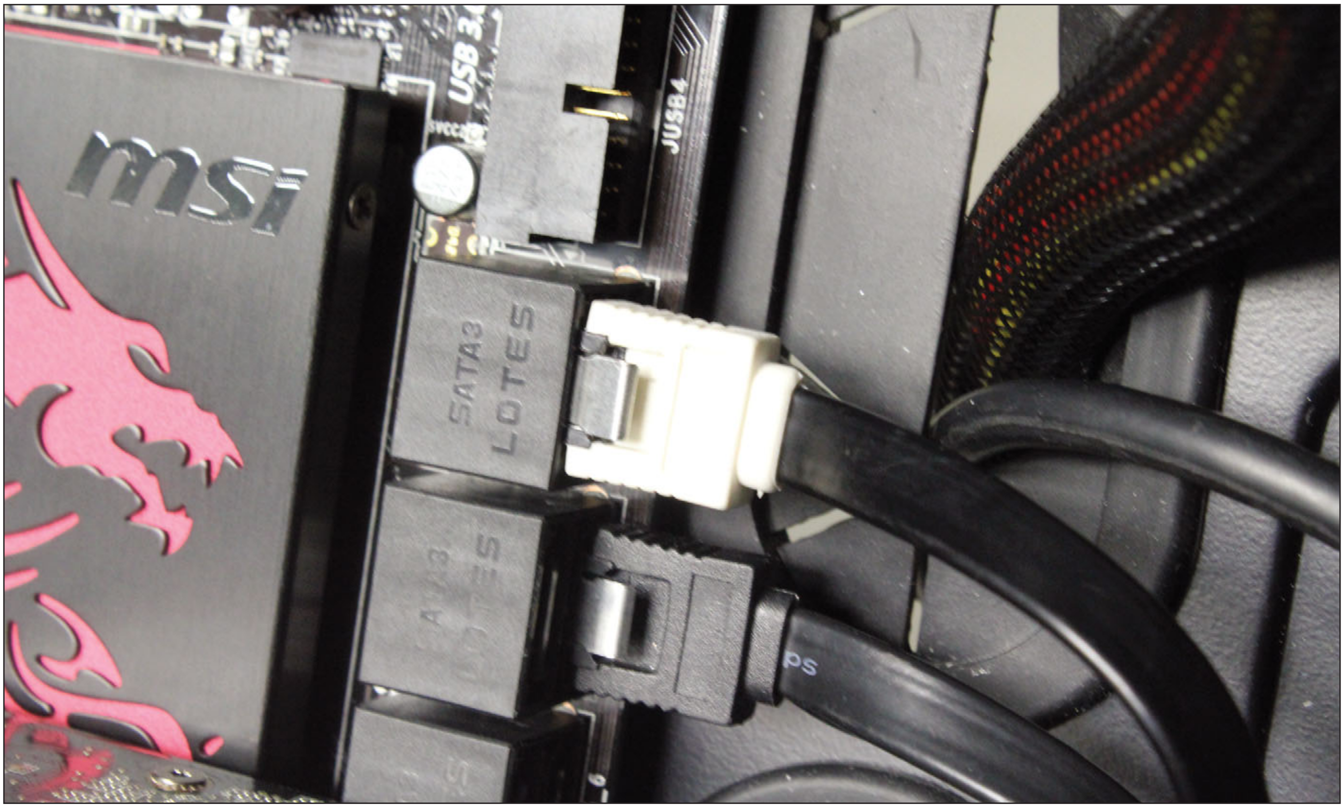
The Clash Between Graphics & Data

Going to use your system for gaming, even if that's not its primary function? You need a graphics card—simple as that.

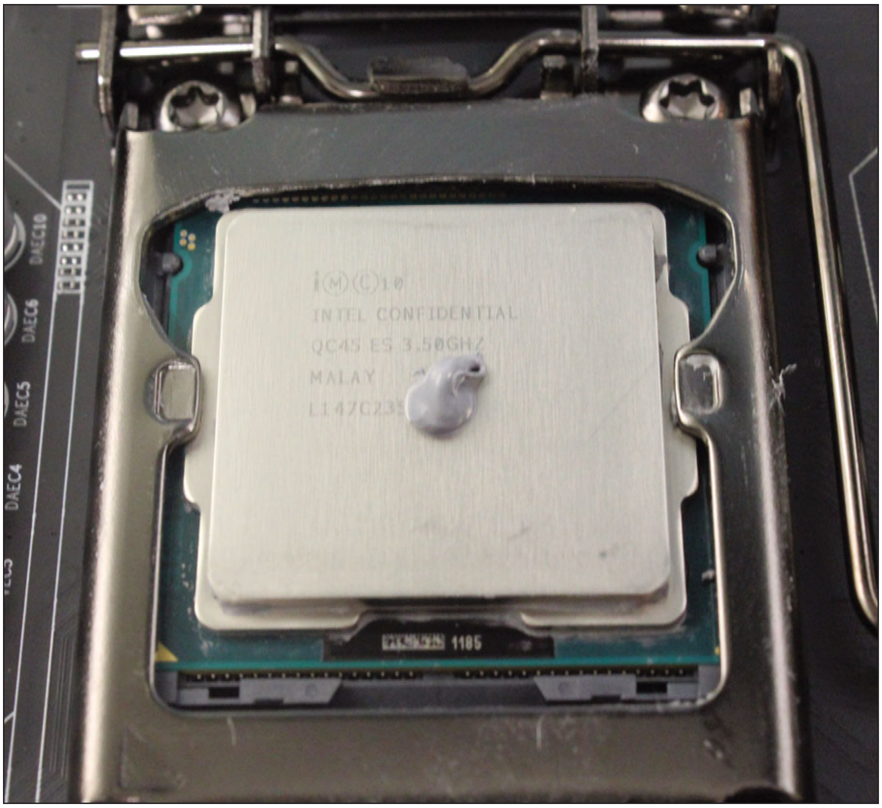
Graphics cards take up a lot of space, in every direction, but we'll assume you took our advice last month and compared specs to determine that the graphics card you want is compatible with your case. For single-card builds, you'll want to install your graphics card in a PCI-E x16 slot that runs at the full x16 speed. You can double-check your motherboard's slot configuration in the manual, but if your motherboard has multiple PCI-E x16 slots the one you want is almost always the topmost slot. Those building a system with SLI or CrossFire will definitely want to check their motherboard's manual to determine the right slot for each card.

Depending on your motherboard's arrangement of slots and connectors, attaching your SATA cable(s) before installing your graphics card(s) is a good move. As we mentioned last month, monster graphics cards frequently hang over a motherboard's SATA connector, which makes connecting SATA cables post-graphics installation a minor pain.

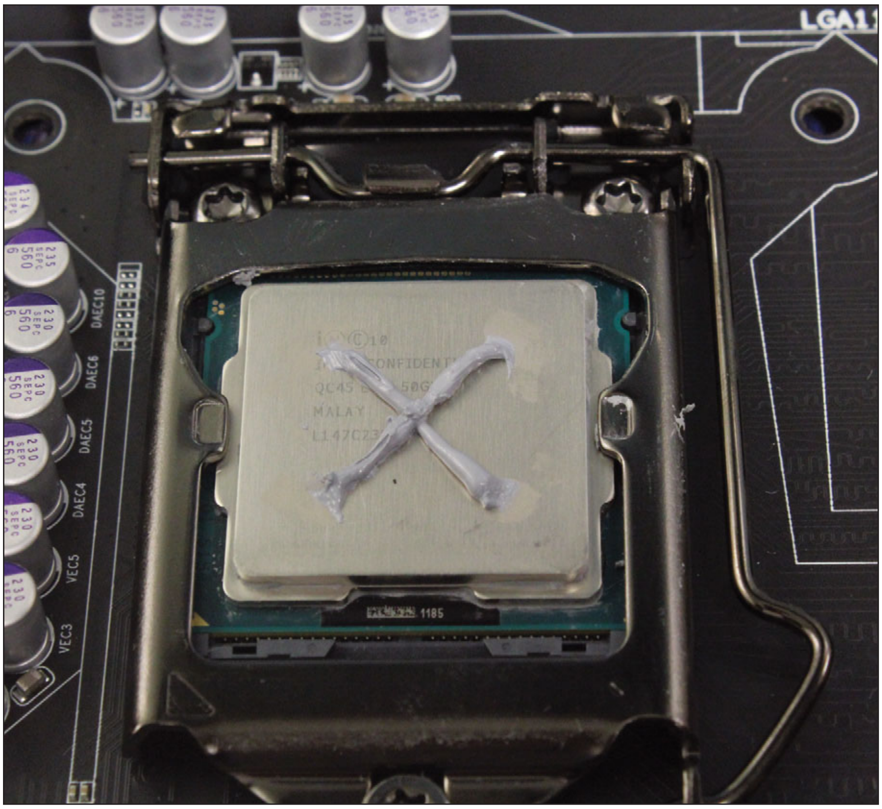
When connecting SATA cables, match the interface a given drive uses with the appropriate SATA connector



Save yourself a headache—connect your SATA cables before you install your graphics card(s).



When it comes to applying thermal compound, less is more. We're not rebooting "The Blob" here, kids.

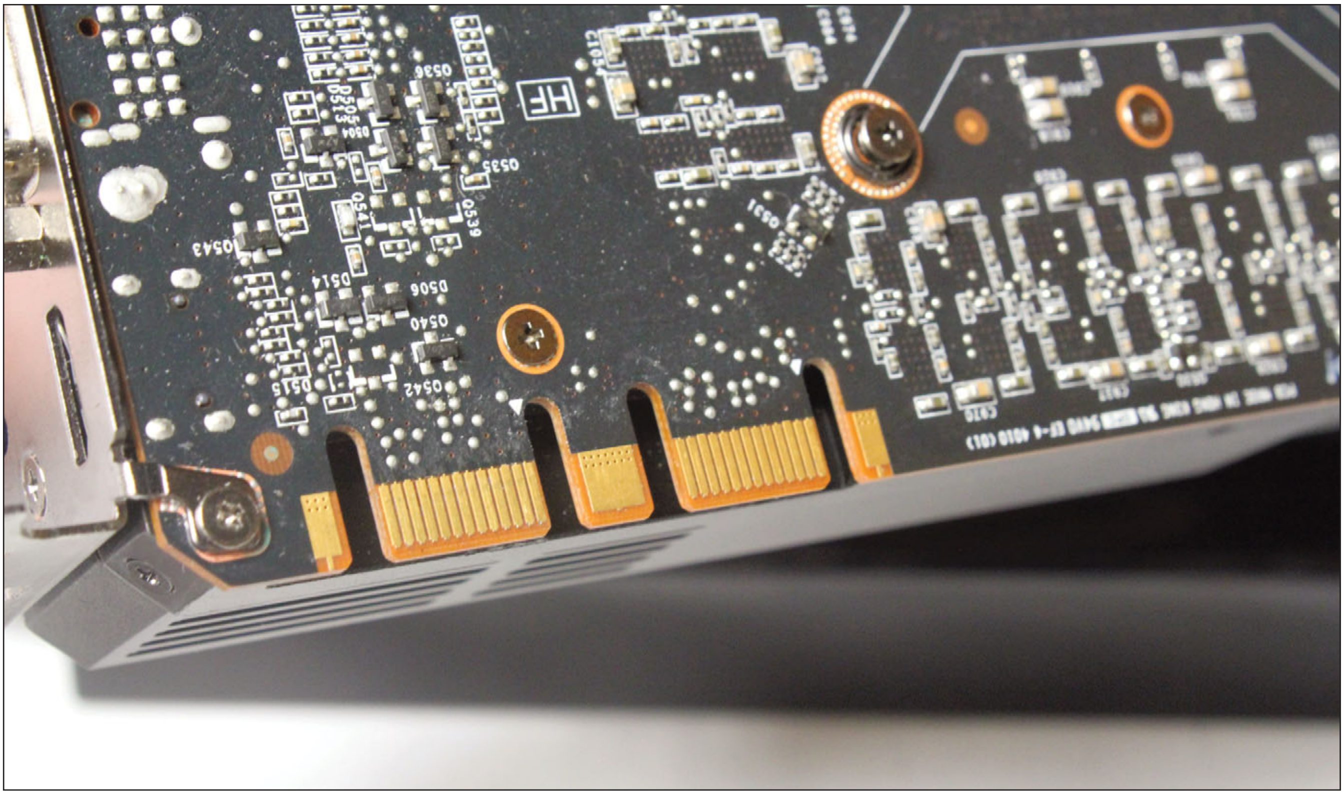


on your motherboard. Hopefully, you bought a 6Gbps solid-state drive for your operating system, at the very least. (If you didn't, sigh, that's OK.) Again, your motherboard's manual will help you find the 6Gbps connectors. Because they're unable to saturate the 3Gbps SATA interface, you can connect SATA cables for your HDDs and ODDs to either 6Gbps or 3Gbps without creating a performance bottleneck. After you've connected your SATA cables to your motherboard, feel free to install your storage drives.

Now that you've taken care of your build's SATA cables, you should be ready to install your graphics card(s). Your case should have thin metal blanks installed over the rear expansion slots. Remove the blanks that correspond with your graphics card's mounting bracket. Next install the graphics card and secure it to the case with the screws that held the expansion slot blanks in place.

If you do have more graphics cards to install, the difficulty needle moves from "easy" to "still easy, provided you check the manual." Different motherboards handle multi-GPU slot configurations differently. Motherboard A might use PCI-E x16 slots 1 and 2 for a two-card configuration, while Motherboard B might use slots 1 and 3. You motherboard's manual won't lead you astray.

After you've installed your graphics cards, you'll physically link them together by way of a bridge, regardless of whether you've sided with SLI or declared your loyalty to CrossFire. In some cases, the bridge is a semi-flexible ribbon (common in two-card configurations), but you might find yourself using a small, rigid PCB bridge (often used in three- or four-card setups). Look for the bridge(s) you need in your motherboard and/or graphics card boxes. (They should be clearly labeled.) At the edge of each card, close to the rear mounting bracket, you should see a set of gold finger "teeth." Connect the bridge to these in order to connect the cards. You'll be able to enable



Connect multiple graphics cards in SLI or CrossFire by using a bridge, which slips over the graphics cards' gold finger "teeth."

SLI or CrossFire within your graphics driver utility.

Chill, Bro

Another mandatory component in your system build is the CPU cooler. Your processor works hard to make all that magic. The least you can do is throw it a towel when it breaks a sweat. It's time to unbox your cooler and get it in your system, stat.

Because of the variety of coolers and their different mounting brackets, we'll cover cooler installation in general terms. Hopefully, you've already assembled and attached any type of backplate behind your motherboard. If not, most enthusiast cases these days do have that area of the motherboard tray cut out to provide access even if you've already installed your motherboard. Next, put together as much of the mounting assembly as you can without securing the heatsink (or waterblock, if you're going liquid) to the CPU.

Flip your cooler over and inspect its base. Take off any protective covering (duh), whether it's a hard plastic shell or a thin sticker, and check to see if the manufacturer preapplied thermal compound. If it did, you're ready to proceed. If it didn't, scour the cooler's box in search of the thermal compound the manufacturer should have included. Often, this takes the form of a small syringe, but we've seen companies fill up a packet of the stuff, too (think ketchup, but please, don't try it with French fries). You'll need to apply a thin layer of thermal compound between the cooler's base and the CPU.

There are hundreds of experts who are eager to share "the one true way" to apply thermal compound. We'll let you in on a little secret. Unless you're going after a personal best CPU overclock, you shouldn't obsess over a pristine application. Generally speaking, you don't want to put too little (like the head of a pin) and you don't want to put too much (yes, a marble-sized glop is way too much). We've found a couple of methods have given us the best results. You can put a small bead (a little less than the size of a pea) of thermal compound in the center of the CPU, or you can make a small "X" about halfway to each corner of the CPU using very thin lines (about the thickness of an uncooked grain of rice).

After you've applied the thermal compound, use your heatsink or waterblock to distribute the compound before tightening everything together. A 45-degree twist in either direction should be more than enough to get the right coverage. You should be ready to screw/bolt/fuse-with-heat-vision your cooler to its mounting assembly for a secure fit.

A quick note for those of you installing a closed-loop liquid-cooler: You might think you have to connect the cooler's pump/waterblock assembly to the CPU fan power header on your motherboard. After all, the waterblock is closest to your CPU. However, we recommend connecting the radiator's fan to this header. Because most of today's fans use PWM (pulse width modulation), they'll only spin as fast as necessary (and thus be

One trick we've found that works more often than not: routing the CPU power cable underneath your graphics card(s).

quieter during low-load periods). When in doubt, pay close attention to your cooler's installation instructions, which should indicate the appropriate headers to connect your pump and fan(s).

PC Power & Cabling

With all of your hardware installed and connected at this point, you need the one component that makes everything go: the power supply. Without the PSU, you're left with an expensive collection of inert silicon. Let's hook everything up, so our components can start juicing.

Hopefully, your case has a handful of precut holes along the edge of its motherboard tray that you can use for cable routing. Your general strategy should be to send your PSU cables in through one hole and out through another. Frequently, the largest cable management hole will be adjacent to the PSU, since you'll be funneling the bulk of your cables through it. Next, try to pull cables through the hole closest to each cable's respective connector.

We start with the main ATX power cable. This is your thickest cable and largest connector, so it's much easier to route when the cable management holes aren't already clogged with a bunch of other cables.

Up next are the cables for your graphics card(s) and CPU. Typically, a PSU's bundle of hardwired cables will include any CPU power cables and enough PCI-E cables to connect a graphics card or two; we like to use as much of the hardwired bundle as possible to keep our system's cabling to a minimum. If you have multiple graphics cards, you may find yourself using separate cable management holes for each card. Experiment to find what cabling arrangement works best for your combination of case and cards.

CPU power cables are frequently tricky, because motherboard manufacturers like to put the CPU power connectors in the upper-left corner of the board. Thus, routing the necessary cables behind your motherboard tray can range from difficult to impossible if you match a tall case with a short PSU cable. In the event that you find yourself in such a situation, an extension cable can be a godsend, but they're not always included with cases or PSUs. It's a great investment if you need the extra length, but while you're waiting for it to arrive, you may have to drape that CPU power cable over your internal components.

One trick we've found that works more often than not: routing the CPU power cable underneath your graphics card(s). Most graphics cards have notch in their PCB that you can find on its motherboard-side edge, close to the rear mounting bracket. When a graphics card is installed, this notch works as a great improvised channel to route a CPU power cable. Just spare yourself the headache and remove the graphics card first, if you've already installed it. Then, route and connect the CPU power cable and reseat the graphics card, making sure the card's notch lines up with the cable.

Take a minimalist approach with the rest of your drives and peripherals. We'll frequently rearrange our storage drives in their bays in order to use a single cable of SATA power connectors, for example. Optical drives can be tough, since most people install them in the top 5.25-inch external bay, and thus builders often find themselves running a separate cable to their ODD. Don't sweat it if you have to do the same.

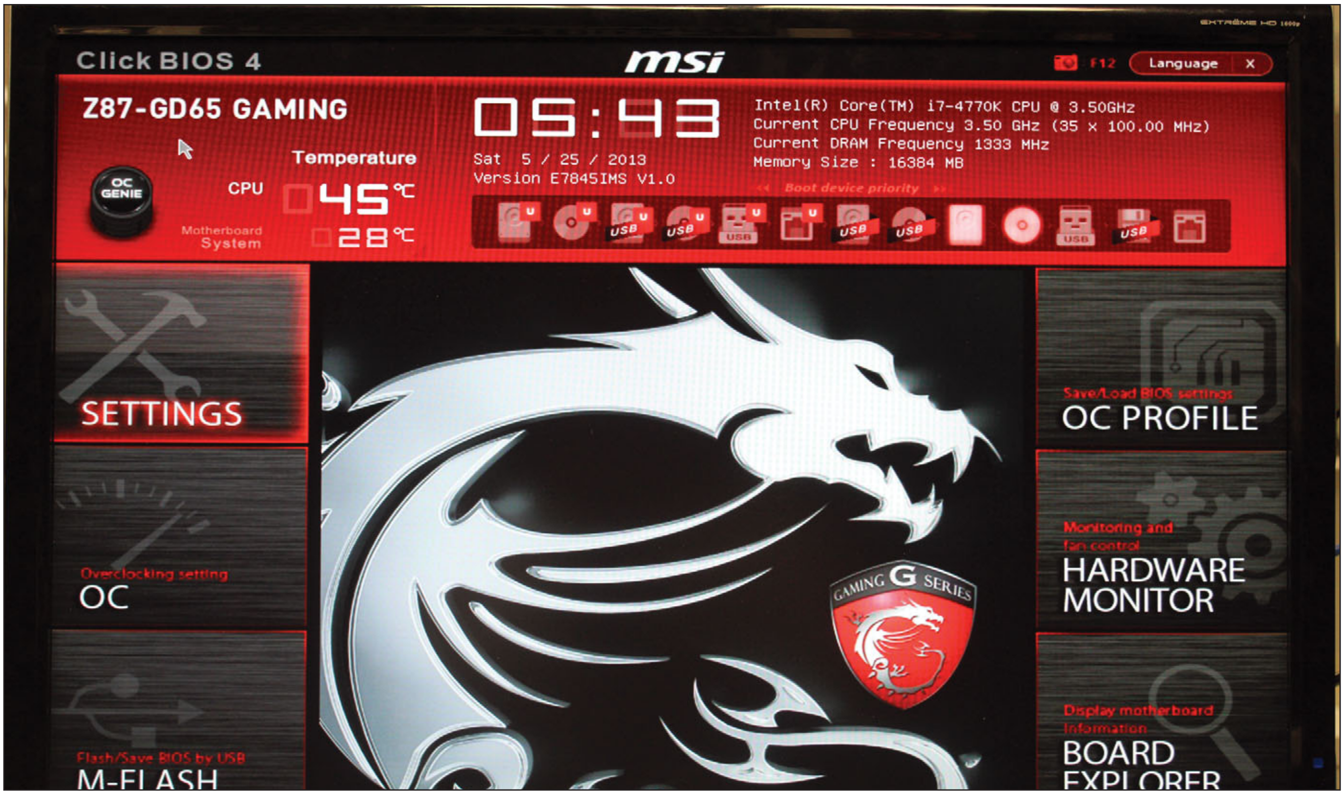
The thinnest cables are those connected to your case's front panel. The standard configuration consists of cables for the power and reset buttons and the power and storage LEDs. These will connect to headers on your motherboard, which should be grouped up in the lower-right corner of the board. Your motherboard's manual will have a diagram that shows where to connect each cable.

The vast majority of enthusiast cases will also have USB and audio ports, so you can expect to see cables for those, too. USB 2.0 and USB 3.0 cables use different motherboard connectors, but they should be labeled on the board and in the manual. USB 2.0 headers are ubiquitous at this point, but don't be surprised if you motherboard doesn't include an internal header for USB 3.0. If you find this to be the case, simply leave the case's USB 3.0 cable tucked away behind the motherboard tray.

After all of your power and data cables are finally connected, you can probably clean things up even further. Where your cables come together and naturally form loose bundles, a few strategically placed zip ties can cinch everything together and make your cabling job even cleaner. When you have cables that you can't run behind the motherboard tray, look for ways to route them discretely, taking advantage of your case's hiding places—corners, grooves, and so forth.

The Cold Boot

You're in the home stretch. Now that your uber rig is fully assembled and connected, it should actually do something when you plug it and press the power button. Lights will flash! Fans will spin! And . . . without an operating system, not much else.


Z87-GD65 GAMING

05:43

Sat 5 / 25 / 2013

Version E7845IMS V1.0

Intel(R) Core(TM) i7-4770K CPU @ 3.50GHz

Current CPU Frequency 3.50 GHz (35 x 100.00 MHz)

Current DRAM Frequency 1333 MHz

Memory Size : 16384 MB

Temperature

CPU 45℃

Motherboard System 28℃

Welcome to your motherboard's BIOS. Here, you can set your system's boot order, change memory speeds, and about a zillion other things. (We counted.)

Don't worry, though. You're in good shape. Provided all of your components are installed correctly, loading the software essentials is a relatively straightforward task. When you power on your system for the first time, keep your eyes peeled for your motherboard's splash screen. Most of the time, the splash screen consists of the name of your motherboard manufacturer and the motherboard itself, plus a sweet graphic. It's hard to miss.

The instructions you need for entering your motherboard's BIOS, on the other hand, are not hard to miss. Think of this as the splash screen's fine print. You'll usually find the text along the bottom of the screen. What you want is "Setup," "BIOS," or something similar. Press the key associated with this option (usually DEL or F1) to enter the BIOS.

We'll be making two stops while we're in BIOSlandia, one vital and one important enough that it might as well be vital, too. First, navigate to your system's boot menu. To make things simple, assign your optical drive the first spot in the boot order. You can tinker with the boot order afterward, but your top priority at the moment is booting your OS' installation disc.

Before you exit the BIOS, set your memory to its rated speed. These days, Intel and AMD both have preset memory profiles, and your motherboard and memory modules should support these profiles, as well. Manufacturers stash the profile settings in a couple of different places; more often than not the menu will be labeled as something synonymous with "advanced performance settings," whether the actual menu is "MEGA OVERCLOCK TUNING" or simply "More Cowbell." (Bruce Dickinson, you have our number. Let's make gold motherboards, baby.) Navigate to this menu, find the memory profile setting, and select the profile you want.

Next, eject your ODD's disc tray and insert your installation disc. Close the tray, save your changes to the BIOS, and exit the BIOS. If done properly, your system will boot to the installation disc. Shortly after this, you should see a prompt to press any key to start the installation. Well, press one!

Now, if you can follow our instructions in this article and nothing has blown up, following the on-screen instructions should be a piece of cake. Before you know it, you should be staring at a clean installation. You'll have basic functionality at this point. All you should have to do to complete your build is to install the drivers for your hardware and, optionally, any utilities included with your components, then it's on to the good stuff.

About That Good Stuff

Although we could let you take it from here, we invite you stop by next month as we put the finishing touches on your first system build. We'll cover testing, troubleshooting, optimization, and more, because if you've spent a lot of time meticulously assembling your components, don't you owe it to yourself to be equally meticulous about fine-tuning everything? ■

Is Your Power Supply Ready For Haswell?

In Win Has You Covered

GreenMe & DESERT FOX COMMANDER III
www.inwin-style.com

Intel's new Haswell processors feature a C6/C7 sleep state that will drop their power usage down to 0.05A. That's good for energy efficiency, but bad for some power supplies, because it can be difficult for some models to provide a stable voltage at such low loads. The problem occurs when you put the PC to Sleep and the components using the +3.3V and +5V rails, such as SSDs and memory, require a load that goes out of specifications. The PSU's voltage protection will trigger automatic shutdown, which can create conflicts that cause system crashes and errors.

To support the new low-power Haswell sleep state, you'll want a PSU equipped with a DC-to-DC converter, such as In Win's GreenMe and DESERT FOX COMMANDER III lineups of power supplies. The DC-to-DC converter splits power from the +12V rail to create the +5V and +3.3V rails, which ensures that power supply can handle the low CPU power state. In Win's power supplies also provide a number of energy efficiency, power protection, and design features that ensure the components in your rig are receiving high-quality electricity.

Meet GreenMe

The GreenMe power supplies (available in 550, 650, and 750 wattages) boast full protection for over voltage, under voltage, over power, over current, and short circuit conditions. All models offer an energy efficiency up to 85%, which meets the 80 PLUS Bronze certification. For quiet operation when idle, In Win equips the GreenMe power supplies with a 120mm fan that bases its speed on load and temperature. As such, it'll increase the fan speed only when the load or internal temperature goes beyond preset thresholds. The GreenMe power supplies ship in boxes that are 100% recyclable, because they are made of recycled cardboard and printed with natural soy ink.

Meet DESERT FOX COMMANDER III

In Win paints these power supplies with a desert camouflage color and labels them with military stencil, which gives the PSU a unique look that will blend nicely with combat-themed builds. Available in 600, 700, and 800 wattages, the DESERT FOX lineup features modular cabling that will reduce clutter inside your PC. Both the 700-watt and 800-watt models support SLI and CrossFire GPU setups. All of the DESERT FOX power supplies feature a peak efficiency of 90%, which garners them their 80 PLUS Gold certification. You'll also enjoy compliance with ErP Lot 6 for low power motherboard standby. Full component protection is provided for over voltage, under voltage, over current, over power, and short circuit conditions. ■

Advertisement

Create A Windows 8 Installation Flash Drive

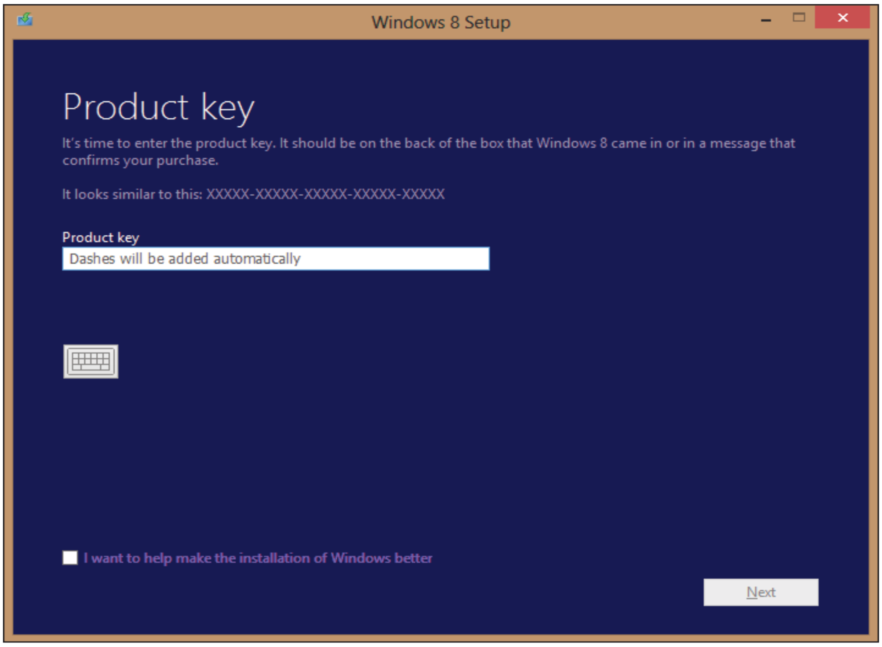
When it's time to install Windows 8, most people will opt either to purchase a retail disc or download the install files from Microsoft's website. But there's also a lesser-known third option that system builders will likely prefer: installing Windows 8 from a USB drive. This lets you easily install Windows on PCs that don't have a network connection or ready access to an increasingly obsolete optical drive. In this month's "Software Tips & Projects," we'll walk you through the process of creating your own Win8 USB installation drive and offer a handful of tips on how to recover a misplaced Windows 8 product key.

Get Windows 8

To create the USB drive-based installer, you'll need a legitimate retail copy of Windows 8 with a product key. If your Windows 8 came preinstalled with your PC and you only have an OEM recovery disc, you won't be able to create a USB installation drive. Part of the reason you're required to input a product key is to determine if the license you purchased (OEM or retail) supports a USB-based install. OEM versions of Windows 8 can only be reinstalled using the recovery partition of your computer (if available) or the OEM disc that came with your device.

Find A Working Computer

Next, find a computer that has an active Internet connection and a USB port. You can use a Win8, Win7, Vista, or WinXP SP3 computer to create the drive, but remember that this doesn't have to be the computer you plan to install Windows 8 on. Also note that if you want the USB drive to install a 64-bit or 32-bit copy of Windows 8, you



Product key

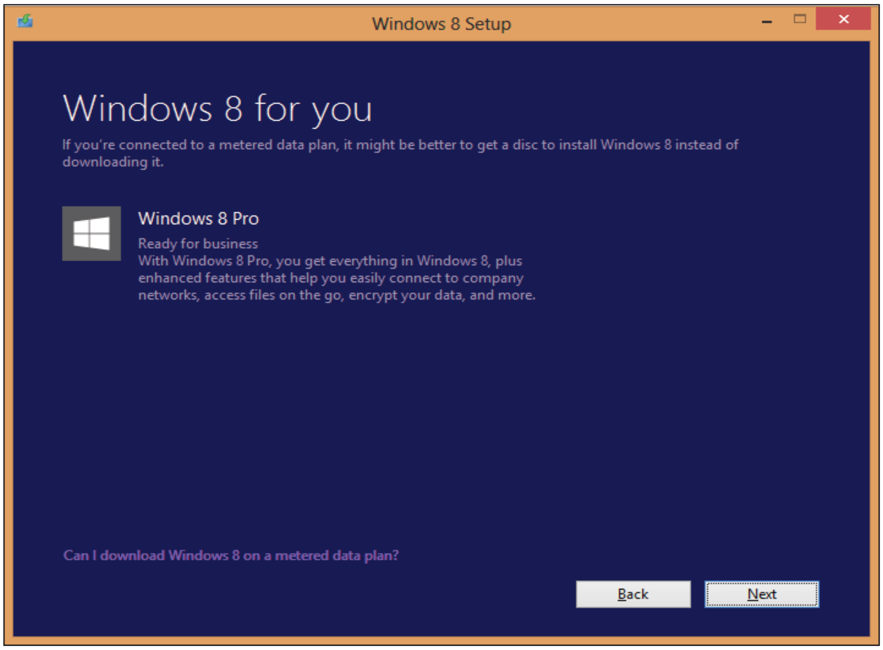
It's time to enter the product key. It should be on the back of the box that Windows 8 came in or in a message that confirms your purchase.

It looks similar to this: XXXXX-XXXXX-XXXXX-XXXXX-XXXXX

Product key: Dashes will be added automatically

☐ I want to help make the installation of Windows better

Even though you won't be installing Windows 8 yet, you'll still need the product key.



Windows 8 for you

If you're connected to a metered data plan, it might be better to get a disc to install Windows 8 instead of downloading it.

Windows 8 Pro
Ready for business
With Windows 8 Pro, you get everything in Windows 8, plus enhanced features that help you easily connect to company networks, access files on the go, encrypt your data, and more.

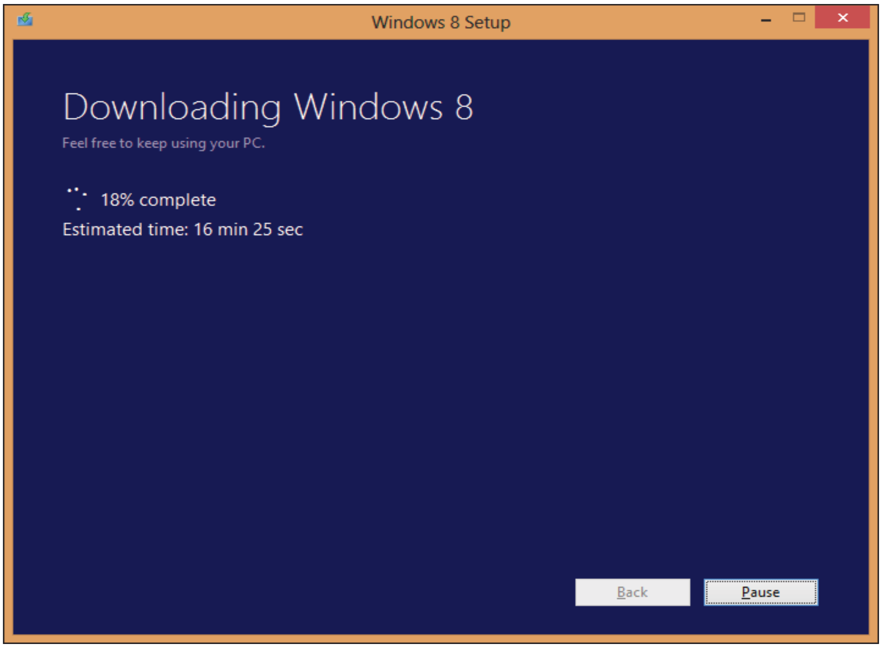
Can I download Windows 8 on a metered data plan?

This screen verifies the version of Windows that will be transferred to your USB drive.

should perform this operation using a PC running a corresponding 64- or 32-bit version of Microsoft's OS. The language settings of the source computer also determine the language of the installer on the USB drive, so make sure they're consistent.

Download The Installer

The next step is to download the Windows 8 Installer from tinyurl.com/92rc7xk. Although this Microsoft page warns you that you need to be using the computer you plan to upgrade, you can ignore that for now because you'll be choosing the Install By Creating Media option. Click the Install Windows 8 button on this site and then click Save to download the installer executable.


Windows 8 Setup

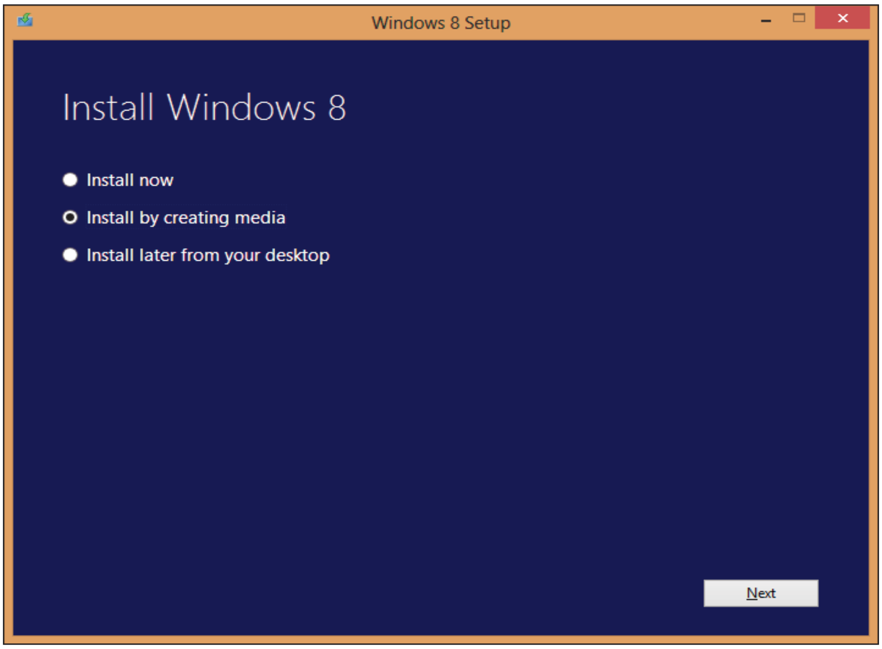
Downloading Windows 8

Feel free to keep using your PC.

18% complete

Estimated time: 16 min 25 sec

Depending on your connection speed, downloading Windows could take a while.


Windows 8 Setup

Install Windows 8

○ Install now

● Install by creating media

○ Install later from your desktop

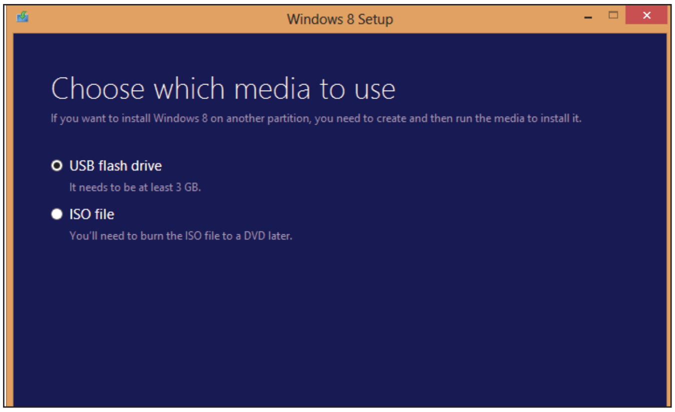
Choose the Creating Media option to continue.

Double-click the downloaded file, named Windows8-Setup.exe, click Yes if you receive a UAC prompt, then input the Windows 8 product key and click Next. If you don't know the product key, refer to the "Windows Tip Of The Month" sidebar for tips on recovering it. After a short wait, you'll see a screen that displays the version of Windows you're about to download (as determined by the product key you entered). This screen also warns that you should not attempt to download Windows 8 while on a metered plan; doing so will consume a considerable amount of your allotted bandwidth. The Windows 8 install files will consume approximately 2.7GB of your USB drive when all is said and done. Click Next to continue.

Copy Windows 8 To The USB Drive

While Windows downloads, you'll see the percent completion as well as the estimated time remaining. On our test machine, we can typically achieve a speedtest.net score of 10Mbps or better for downloads, which let us download the Windows 8 install files in approximately 20 minutes. A slower connection will result in a more time-consuming download. When the files are downloaded, click the Install By Creating Media radio button and click Next.

If you plan to install Windows on a separate partition on this or another computer, Microsoft's Windows 8 installer recommends you create the new partition now. You can do this using the Disk Management snap-in, accessible by right-clicking Computer (in desktop mode), clicking Manage, and then clicking Disk Management from the left pane of the Device Manager. Right-click the disk you want to add a partition to, then click Shrink Volume if there's no unformatted space



Choose which media to use

If you want to install Windows 8 on another partition, you need to create and then run the media to install it.

○ USB flash drive
It needs to be at least 3 GB.

● ISO file
You'll need to burn the ISO file to a DVD later.

From here, you can create a bootable USB drive or ISO that you can burn to a disc.

available. When that's done, use the utility to format the unallocated space as a new partition.

Now you will need to get your hands on a USB drive that has a formatted capacity of 3GB or more. Your typical 4GB flash drive will format to between 3.6 and 3.8GB, which is plenty. Back on the Win8 Installer, you can select USB Flash Drive or ISO File; choose the former by clicking the appropriate radio button, and then click Next. The installer utility will search your computer for suitable USB drives and display them on the following page. We recommend disconnecting any unnecessary USB drive to ensure the Win8 install files go to the intended drive. Click the drive you want to use from this screen and click Next to continue. The utility prompts you that it is about to format the USB drive for use as a bootable install drive, so any files on it will be deleted. Click Yes to continue. The utility will then prepare and

WINDOWS TIP OF THE MONTH:

Find Your Windows 8 Product Key

For the most part, you only need your Windows product key when performing an install or reinstall. Because most of us go several months, even years between reinstalls, it's easy to lose track of the product key. Here are a handful of ways to recover your Win8 product key.

If, when you initially purchased Windows 8, you downloaded it from Microsoft's site, then your product key was sent to you in an email. Search your inbox for the product key and then write it down or print it out. If you bought a retail copy of Windows 8, then the product key is printed on a card in the Windows 8 box. If you obtained Windows 8 by purchasing it preinstalled on a notebook, tablet, or PC, then look for a product key sticker on the device, or bundled with the OEM-supplied reinstall media.

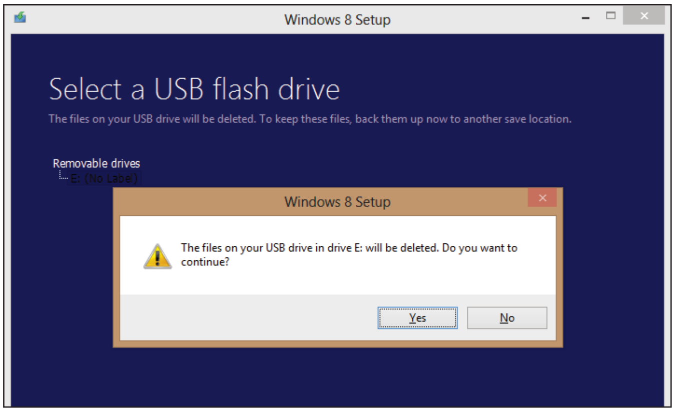
As long as you haven't installed the Windows 8 Media Center Pack or a volume license version of Windows 8 on your computer, then you can easily recover the key from the Windows Registry by downloading and installing a lightweight key finder utility. We've used several, including Belarc Advisor (www.belarc.com) and The Magical Jelly Bean Keyfinder (www.magicaljellybean.com/keyfinder), both of which are free for personal use. Just install the application and run it to see the Win8 product key.

There are two instances when the product key finders mentioned above may fail to work. If you installed a volume licensing version of Windows 8, the key finders may display the product key as BBBBB-BBBBB-BBBBB-BBBBB-BBBBB. The other reason might be because you installed the Windows 8 Media Center Pack. In order to activate the software, you needed to type in a product key specific to the expansion; however this has the unfortunate side effect of replacing your Windows 8 product key in the Registry. To recover your Windows 8 key and make sure it can be found in the Registry where it belongs, you'll need to call Microsoft support and then uninstall Windows Media Center.

Start by visiting support.microsoft.com/gp/esd-support-phone-numbers, scroll to your country, and then call the phone number listed. When you call, make sure you have the email address you used for the original electronic purchase, or the credit card you used. After confirming these details, Microsoft will send you your product key by email. Make sure you print it out or write it down somewhere to keep from losing it again.

To continue with the removal of Windows Media Center, go to the Windows 8 Start screen and type regedit. Press ENTER to launch the Registry Editor, click Yes on the UAC to confirm the operation and then navigate to HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion. Next, double-click EditionID from the right pane of the Registry Editor, change the value data to Professional, and click OK. Next, double-click ProductName from the right pane and change the value data to Windows 8 Pro, then click OK. Close the Registry Editor, and then restart the PC. Insert the installation disc into the optical drive or plug the Window 8 install UDB drive we just showed you how to create and launch Setup.exe. Click Yes if prompted with a UAC message.

Next, click the Go Online To Install Updates Now radio button, then click Next. Type the Windows 8 product key you got from Microsoft and click Next to proceed. Choose the Keep Windows Settings, Personal Files, And Apps option by clicking the appropriate radio button, then click Next. Click Install from the Ready To Install screen to complete the operation. Then just follow the on-screen prompts to finish the install of Windows 8 on your system. When you're finished, your computer should look and feel just like it used to, with the exception of no longer being able to access Media Center. ■



Select a USB flash drive

The files on your USB drive will be deleted. To keep these files, back them up now to another save location.

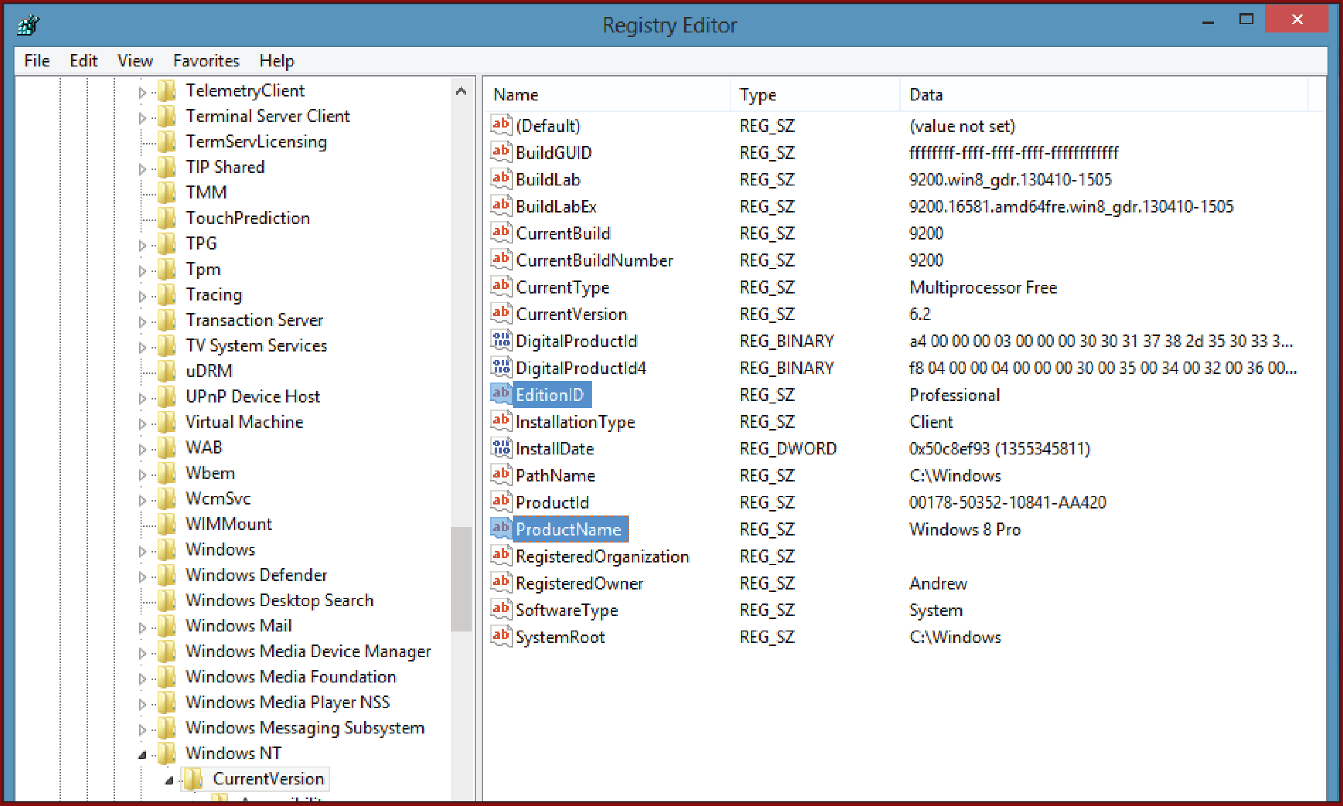
The files on your USB drive in drive E: will be deleted. Do you want to continue?

We've said it before, we'll say it again: Back up any files you don't want to lose.

create the USB flash drive. This operation took about 10 minutes on our test machine. When it completes, the utility will show you the Windows product key one more time; make sure you have access to it or, if you haven't written it down already, do so now. You can click the Finish button to close the window.

Time To Reinstall

The next step is to plug your new USB Win8 installation drive into the computer you want to install Win8 on and boot from it. To do this, shut the computer down, access the BIOS by pressing the DELETE, F1, F2, ESC, or F12 key, and then change the boot order so that the first device is the USB drive you just created. Save the changes and restart the computer. Then just follow the on-screen prompts to install Windows 8 from your USB drive. ■



Name	Type	Data
(Default)	REG_SZ	(value not set)
BuildGUID	REG_SZ	ffffffff-ffff-ffff-ffff-ffffffffffff
BuildLab	REG_SZ	9200.win8_gdr.130410-1505
BuildLabEx	REG_SZ	9200.16581.amd64fre.win8_gdr.130410-1505
CurrentBuild	REG_SZ	9200
CurrentBuildNumber	REG_SZ	9200
CurrentType	REG_SZ	Multiprocessor Free
CurrentVersion	REG_SZ	6.2
DigitalProductId	REG_BINARY	a4 00 00 00 03 00 00 00 30 30 31 37 38 2d 35 30 33 3...
DigitalProductId4	REG_BINARY	f8 04 00 00 04 00 00 00 30 00 35 00 34 00 32 00 36 00...
EditionID	REG_SZ	Professional
InstallationType	REG_SZ	Client
InstallDate	REG_DWORD	0x50c8ef93 (1355345811)
PathName	REG_SZ	C:\Windows
ProductId	REG_SZ	00178-50352-10841-AA420
ProductName	REG_SZ	Windows 8 Pro
RegisteredOrganization	REG_SZ	
RegisteredOwner	REG_SZ	Andrew
SoftwareType	REG_SZ	System
SystemRoot	REG_SZ	C:\Windows

You'll need to tweak the Registry and refresh your Windows 8 install to fully remove the Windows 8 Media Center.

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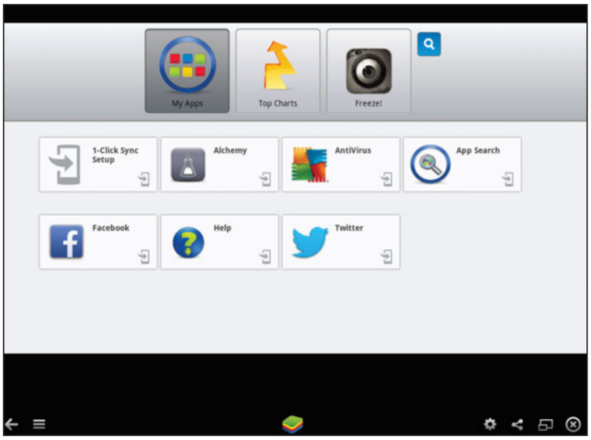
Inside The World Of Betas

BLUESTACKS APP PLAYER 0.7.12 BETA



BlueStacks App Player 0.7.12 beta
Publisher and URL: BlueStacks, www.bluestacks.com
ETA: 2013
Why You Should Care: Run Android apps on your Windows PC.

Few power users deal with only one computing platform, especially now that iOS and Android devices have become ubiquitous. This Win7 program lets you run Android apps on your PC (there's a Mac beta, too) without having to install a software dev kit.

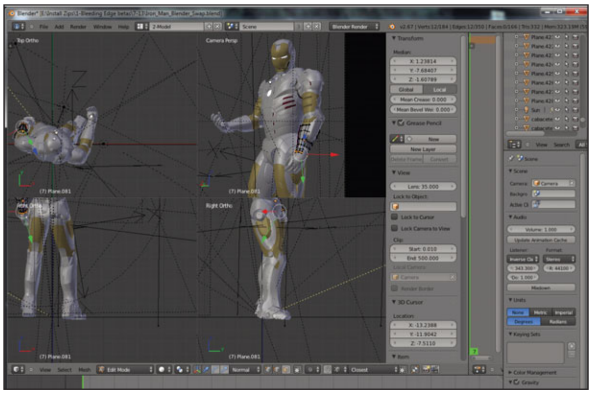
Perhaps you'd like to play a mobile game on a larger screen without having to re-buy it in PC form. Maybe certain apps lend themselves more to the finer control of a mouse pointer than to your fingertips on a touchscreen. There might not be enough storage space on your phone for all the apps you would like, and so your PC could act to handle the overflow. Or, in the end, you may simply prefer a favorite Android app over an equivalent Windows application or gadget.

BlueStacks App Player's home screen gives you a tiled view of your installed Android apps. It comes preinstalled with AVG antivirus for Android, plus Twitter, Facebook, and more. Search for a new app by name, and the emulator will offer you a choice of download sources for it, including Google Play and the Amazon Appstore.

Moreover, BlueStacks can sync with your Android mobile device. We like that you can run BlueStacks in either a windowed or full-screen mode. It worked well with a handful of apps we tried, including Kik Messenger, a game called Alchemy, Twitter, and so on.

That said, we do hope that future versions of the installer let you choose an installation drive other than the default C: volume. A little more installation flexibility would have postponed a cleanup session on our SSD boot drive until a more convenient time. ■

BLENDER 2.67A



Blender 2.67a
Publisher and URL: blender.org, www.blender.org
ETA: 2013
Why You Should Care: This free software lets you do movie-like CG, 3D printing, animation, and more.

Ever watch an indie YouTube clip and get blown away by the CG somebody created in his spare time? That power can be yours, power user, for the low, low price of nothing.

Blender is free, open-source software along the lines of Autodesk Maya and 3ds Max, in that it offers 3D modeling, animation, rendering, sequence editing, and more.

In case seeing "free" and "open source" lower your expectations of the kind of quality you should expect from Blender's effects, look up the "Tears of Steel" short film on YouTube. It was created to flaunt the software's considerable power and flexibility.

Blender takes advantage of multi-core processing and Intel Hyper-Threading, which can cut rendering time considerably. The software also features support for add-ons such as the research-centric Mitsuba rendering system.

Version 2.67a brings more than 100 bug fixes to the 2.67 release, which augmented cartoon creation with a new Freestyle rendering engine, among other improvements. You can even create 3D printing projects with Blender, thanks to a new add-on.

We used the 64-bit Windows version to noodle around with a variety of user-generated projects from the BlendSwap.com community. There were no stability issues, although it pays to keep an eye on a system resource monitor utility to reassure yourself that the software is busy, not hanging. Blender also comes in 32-bit Windows and 64- and 32-bit editions for both the Linux and the Mac, so there's no excuse for you not to show Michael Bay how to really make a Transformers movie. ■

Upgrades That'll Keep You Humming Along

Fresh software updates can make your PC or mobile device that much better. Grace your system with some new features and bug fixes.

SOFTWARE UPDATES

Ambient Design ArtRage 4

New features of this touchscreen- and stylus-aware art application include support for Wacom stylus properties, floating views, paint stroke symmetry, new toolbars, a clone tool, and more. Ambient Design has redesigned the user interface for better workflow, and has optimized the app for Windows 8. Versions are available for Win8/7/XP, the Mac, the iPad, and the iPhone.

www.artrage.com/artrage-store.html

EaseUS Todo Backup 5.8

Version 5.8 of this backup and disaster recovery software comes with support for GPT (GUID Partition Table) volumes such as large disk drives, a Windows PE (Preinstallation Environment) boot disc feature, enhanced compatibility, and so on. You can back up your Outlook email, and then browse its backup image in Windows Explorer. Moreover, you can change the email notification template if you like. Todo Backup runs under Windows 8, 7, Vista, and XP.

www.todo-backup.com

IObit Advanced Mobile Care 3.0

This comprehensive system care application for Android devices provides antivirus, anti-theft, game acceleration, and more. A new battery saver feature joins cloud backup, a task killer, and privacy utilities. The free download, which is compatible with Android 2.2 and later, supports tablets such as the Samsung Galaxy Note, Nexus 7 and 10, and the Asus Transformer.

www.iobit.com/advanced-mobile-care.php

NovaStor NovaBACKUP 14.5

The latest version of this backup software from NovaStor comes with speed improvements and support for Microsoft Exchange 2013, Windows 8, and UEFI Secure Boot. NovaBACKUP is now easier to use, especially during the recovery/image boot disc creation process. Version 14.5 remembers your NAS and network locations across backup jobs, and it can restore particular files from a system image.

www.novastor.com/en/release/14.5

Ontrack EasyRecovery 10.1

This data recovery utility now features 64-bit Windows support, helping it to scan drives more quickly and recover larger volumes. Ontrack also built Windows 8 support into version 10.1, along with a new hex viewer for more exact recovery of file contents. Also new are Dutch and Polish language support.

www.krollontrack.com/data-recovery/recovery-software

Pinnacle Studio 16.1

Users of this video-editing suite can now simultaneously edit frame-accurately on unlimited tracks and preview the timeline and source clips. Version 16.1 comes with more than 300 bug fixes and updates, including plug-ins such as Mojo, Magic Bullet, and others. Also new is a large Scorefitter library for fitting custom soundtracks into your projects. Pinnacle even improved the Install Manager and made Studio easier to use right out of the box.

www.pinnaclesys.com

DRIVER BAY

Corsair Vengeance 2000 Headset Driver 2.0.7

This free driver update adds support for Dolby Headphone 2.0 and Dolby Pro Logic IIx to the Corsair Vengeance 2000 Wireless 7.1 Gaming Headset. It's compatible with Windows 8/7 /Vista/XP. The driver also supports Corsair's Vengeance 1500 headset.

www.corsair.com

Nvidia GeForce Graphics Driver 314.22

BioShock Infinite players, here's the GeForce Game Ready driver for your Nvidia-based video adapter. The company claims a performance boost of up to 41% for the game, along with single-GPU gains of up to 60% in Tomb Raider, 23% in Sniper Elite V2, and 13% in Sleeping Dogs. The release also adds new and updated SLI and 3D Vision profiles.

www.nvidia.com/Download/index.aspx

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The History Of The World (Of PC Gaming): Part II

The Commodore 64 was one of the more popular systems to come out before IBM compatibles hit the scene.

Starting with Graetz, Russell, and Wiitanen's Spacewar!; Ralph Baer's Brown Box; and Bushnell, Alcorn, and Dabney's Pong, computer games were becoming a genuine pastime, alongside baseball, going to movies, and watching sitcoms. People were enjoying games in arcades and, to a more limited extent, in their homes.

With the advent of the home computer, however, the gamers who played on the platform tended to have a penchant for working on the hardware side, as well. Upgrading, programming, networking, and swapping code, the early PC gamers learned very quickly that having a fast and capable computer actually enabled a dramatically better gaming experience. In many ways, things haven't changed much at all in the intervening 40 years.

In the second half of this two-part article, we'll expose the internal components of PC gaming's earliest successes, follow a few of the pioneers responsible for leveling up the gaming industry as a whole, and illustrate how the PC enabled them to do what they did better than home consoles and arcades ever could.

Power Glove To The People

Last month, we touched briefly on the Silicon Valley-based Homebrew Computer Club and their instrumental influence on the budding computer hobbyist scene. This organization, and dozens more like it, began forming all over the country. Silicon Valley played host to an unusually high concentration of these emerging communities of electronics enthusiasts.

Two members of the group were high school friends and eventual business partners. Steve Jobs and Stephen Wozniak began experimenting with their own designs, with the goal of making a versatile all-in-one computer that used fewer integrated circuits. Their first piece of hardware, the Apple I, wasn't designed to be mass-produced. They took it to the Homebrew Computer Club meetings to show off and impress other club members. Wozniak recalls freely offering schematics and even made house calls to help assemble the computers. Aside from the simplified electronics, the Apple I made an impression by including a video screen and keyboard.

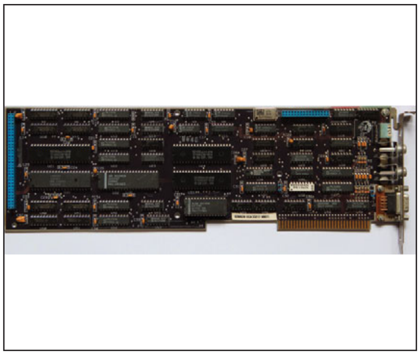
Wozniak claims that many of the Apple II's signature features, including the wired paddles, integrated sound, and high-resolution color graphics, were added out of his and Jobs' desire to get Breakout, the game they initially designed for the Atari, running on the computer. There was no formula for success in the home computing market. Innovation like that found in the Apple I and II came from small teams of visionaries rather than from large corporations.

About the same time, a Radio Shack buyer named Don French designed an all-in-one microcomputer. Tandy, Radio Shack's parent company, (known for making CB radios at the time) was initially reluctant to pursue the new product line, but the company hired Steve Leininger, formerly of National Semiconductor, to help French flesh out the product.

The two insisted that the TRS (Tandy Radio Shack) unit be a premade computer, not a kit like the Altair. Leininger's experience in a computer store called Byte Shop helped him convince the company that a kit was the wrong way to go, saying "too many people can't solder." The $600

The Apple II owes many of its features to the importance of gaming for Jobs and Wozniak.

The Commodore PET, one-third of the '77 Trinity, included a video screen and keyboard.



IBM's EGA (Enhanced Graphics Adapter) was the pinnacle in graphics hardware in 1984.

TRS-80 launched in 1977 and was available from 3,000 Radio Shack outlets across the country.

The unit featured a full-stroke QWERTY keyboard, 4KB of memory, floating point BASIC programming language, and a monitor. Due to corporate skepticism, the initial rollout consisted of 3,000 machines, essentially one for every Radio Shack outlet. In 1978, Radio Shack sold 100,000 TRS-80s, and a year later the TRS-80 had the largest software library of any microcomputer available, despite the Model I's lack of lowercase characters and the considerable RF interference it caused with other electronics.

The TRS-80 shipped with two games preinstalled, Blackjack and Backgammon, but many others later became available on cassette. Unlicensed clones of popular arcade games flooded the system, letting TRS-80 users enjoy games such as Infocom's Zork, Namco's Pac-Man, Atari's Centipede, Exidy's Targ, and Stern Electronics' Berzerk, the latter of which featured digitized speech. Other system-exclusive games also came out, including a shooter called Cosmic Fighter and a Defender clone called Defense Command. And copyright infringment didn't just affect software; the TRS-80 itself was also widely cloned.

The third contributor to the exploding microcomputer market was Commodore International. Before the 1977 launch of the Commodore PET (Personal Electronic Transactor), the firm was best known for making calculators using Texas Instruments CPUs. After TI effectively shut down competition with its internal calculator division, Commodore purchased MOS Technology and used its 6502 processor as the basis for a new all-in-one computer.

Charles "Chuck" Peddle played a key role in designing the Commodore PET. He had been impressed with Wozniak and Jobs' Apple II prototype. He tried to convince Jack Tramiel, Commodore's founder, that computers were the future. Jack told Chuck to prove it by building one. Peddle completed the Commodore PET 2001 model in time for the June 1977 Consumer Electronics Show in Chicago. Although the PET was a success, its green-on-black monochrome screen was a major drawback, especially compared to the Apple II, which included a color display.

For gaming, the PET's saving grace was its versatile ROM-restricted character set, which was based on ASCII-1963 and called PETSCII. The PET's ability to use switchable character sets and load alternative character sets from EPROM connected to the character set ROM socket allowed it to display rudimentary graphics. Text adventures were also popular, which rendered color graphics moot. The PET also supported a Space Invaders clone.

The Apple II, Tandy TRS-80, and Commodore PET helped home computing overcome its reputation for being a niche activity. Together, these three computers were responsible for sparking the home computing revolution. At the time, Byte Magazine called them the "1977 Trinity."

Once the 1977 Trinity had blazed the trail, a flood of new machines followed, including the VIC-20, which was the PET's successor. This microcomputer was notable from a gaming standpoint because of its support for several Scott Adams text adventure games. The VIC-20 shipped with a limited amount of memory, but the designers got around the problem by releasing the text adventures on cartridges with dedicated ROM chips inside.

Machines that debuted in the early '80s include the Commodore 64; Sinclair ZX80, ZX81, and ZX Spectrum; NEC PC-8000, PC-6001, PC-88, and PC-98; Sharp X1 and X68000; the Atari 8-bit family, BBC Micro, Acorn Electron, Amstrad CPC, and MSX series. Electronics manufacturers were looking to cash in on the new trend, and as a result, they were all widely incompatible with one another.

IBM Levels The Playing Field

In 1980, IBM, even then one of the largest corporations in the world, was intent on building its own microcomputer. A typical IBM product would spend four years in development before it ever hit store shelves, but the firm knew that to compete in this new market, it would have to accelerate the production. A team, led by Don Estridge, designed and released the IBM PC on August 12, 1981.

At the time, the gaming industry was worth more than $6 billion in annual sales. Due to the rapid production cycle, Estridge and his team used largely off-the-shelf parts, including the popular Intel 8088 processor. Big Blue also contracted Bill Gates to effectively port Digital Research's CP/M

A Brief History Of Graphics Cards

Introduced in 1981, IBM's CGA (Color Graphics Adapter) video card had a meager 16K of memory and could display four-color graphics using two palettes; white, cyan, magenta, and black; or yellow, green, red, and black. The card could handle a 320 x 200 resolution in color mode or 640 x 200 in monochrome.

In 1984, IBM launched the EGA (Enhanced Graphics Adapter) standard, which upped the visual ante for personal computers of the time, enabling 16 simultaneous colors from a palette of 64. It also supported a 640 x 350 resolution display in color mode and had between 64K and 256K of memory onboard.

In 1987, the graphics subsystem of the PC took another huge leap forward in the launch of the IBM's VGA (Video Graphics Array) standard. VGA could handle 256 simultaneous colors from a palette of over 262,144 colors and resolutions up to 640 x 480. The VGA standard called for a minimum of 256K or memory. Up until Windows Vista, VGA mode was the standard display mode used when Windows booted up.

(Control Program for Microcomputers) operating system, which had become the de facto standard OS running on Intel's 8- and 16-bit processors starting with the popular Intel 8080.

Gates paid $75,000 for Tim Paterson's (of Seattle Computer Products) 86-DOS (also known as Q-DOS, or Quick-and-Dirty Operating System) and tweaked it over the course of six weeks to form the operating system foundation of IBM's machine. Gates called the IBM version PC-DOS, but part of his deal with IBM allowed Gates to release other versions of the OS for competing microcomputers, which he called simply MS-DOS.

IBM was able to launch the first IBM PC, model 5150, in its own stores, through ComputerLand outlets, and other major retailers including Sears. These first machines saw success when marketed as office computers, but they were also widely referred to as personal computers.

Based on the success of the IBM PC, other manufacturers created their own offerings and licensed Gate's MS-DOS to run on them. Because MS-DOS varied so little between these different machines, they came to be called IBM compatibles. Some of the first gaming companies that hoped to capture the home computing market were formed in 1982, including Sierra On-Line, Broderbund, and BudgeCo.

The Apple II and later Apple products, such as the Macintosh, as well as the Commodore Amiga were the only platforms that refused to become IBM-compatible throughout the late -'80s and early '90s. With appetites for games and multimedia as a catalyst, the IBM compatibles saw a number of upgraded subsystems, including the first Creative Music System (1987) sound adapters, and more advanced graphics adapters.

Despite the homogenizing effect of the IBM compatibles, games of this period bypassed MS-DOS entirely, opting to boot from 5.25-inch floppies, and later 3.5-inch floppies, and run custom interface software. By cutting MS-DOS out of the loop, games could access more memory and generally run faster. Between 1980 and 1988, thousands of these "PC Booter" games were released.

Solving The DOS Problem

For the most part, games on IBM-compatible personal computers that ran Win1.x/2.x/3.x all bypassed the operating system to interface with the underlying MS-DOS, which gave them direct access to memory, peripherals, and the audio/video hardware. With Win95, however, Microsoft switched to a protected memory model, which disallowed third-party software from directly accessing these core system components.

Frostbite receives loot: [Bruiseweed].
[Party] [Frostbite]: [Woodseed Hoop][Sagebrush Girdle][Branchclaw Gauntlets]
[Party] [Darkzed]: and if we get wiped at boss i ll %^&*ing unistall wow for a day :)
[Party] [Janie]: liar
[Party] [Lestrange]: lol
[Party] [Darkzed]: slowww

Lestrange's Prayer of Healing heals Janie for 517.
Lestrange's Prayer of Healing heals you for 513.
Your Frost Shock hits Creeping Sludge for 358.
You suffer 285 Nature damage from Creeping Sludge's Virulent Poison.
Creeping Sludge is afflicted by Frost Shock.

World of Warcraft is the king of MMORPGs, and there's little indication of that changing any time in the foreseeable future.

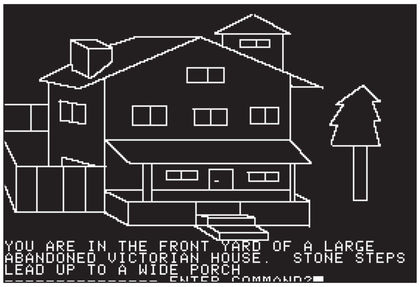
To give game developers the ability to access to all of these crucial systems quickly, without violating the new protected memory standard, a team at Microsoft consisting of Craig Eisler, Alex St. John, and Eric Engstrom created DirectX. To help launch the platform and convince dedicated DOS programmers that DirectX could let them deliver compelling games for Windows platforms, Microsoft hosted a multiplayer session of MechWarrior 2 being played over the Internet at the 1996 Computer Game Developers Conference. Successive versions of DirectX have each added new features to let game developers better utilize the PC's audio and video hardware. Today, DX11 (Win7) brings support for tessellation, more lifelike 3D animation, and multicore processors. Windows 8's DX11.1 includes support for stereoscopic 3D gaming and video.

The Rise Of The Killer Apps

The term "killer app" was used to refer to any piece of software that was so popular that consumers were compelled to purchase the platform just to use it. VisiCalc, WordStar, and Lotus 1-2-3 were three of the system-selling killer apps of the early computing revolution.

As gaming's influence grew, the term came to be associated with console and PC games. For instance, the aging Atari 2600 platform received a boost from what is largely agreed to be gaming's first killer app, Space Invaders. The following is a list of some of the PC's more influential games that left their mark on the platform along with a selection of notable events to provide additional context.

Oregon Trail (MECC, 1971). As one of the earliest edutainment games to debut on the Apple II, The Oregon Trail let players traverse a historically accurate path from Independence, Mo. to Oregon's Willamette Valley. The Minnesota Educational Computing Consortium produced the game, which famously consisted of hunting for game, fording rivers, repairing damages, bartering goods, and dying of dysentery along the way. This is the same year Nolan Bushnell and Ted Dabney's Computer Space debuted.



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YOU ARE IN THE FRONT YARD OF A LARGE
ABANDONED VICTORIAN HOUSE.  STONE STEPS
LEAD UP TO A WIDE PORCH
---------------- ENTER COMMAND?
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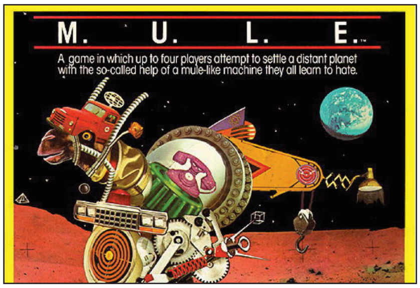
In 1980, Mystery House was one of the first text adventure games to feature graphics on the Apple II.


M. U. L. E.™
A game in which up to four players attempt to settle a distant planet with the so-called help of a mule-like machine they all learn to hate.

M.U.L.E. was one of the first multiplayer games available for the PC.

Dunjonquest: The Temple of Apshai (Epyx, 1979). This adventure game was one of the more successful PC Booters of its time, outselling both Ultima and Wizardry, games that are widely considered groundbreaking and genre-defining.

Akalabeth: World of Doom (California Pacific Computer Co., 1980). Richard Garriott's pet project that he started while still in high school, Akalabeth is generally considered to be one of the first role-playing video games, and the game that would later spawn Garriott's Ultima series.

Wizardry (Sir-Tech, 1981). Successfully capitalizing on the popularity of Dungeons & Dragons, Wizardry went on to become the most popular fantasy adventure game for the Apple II. Mattel's Intellivision console launched this year; it featured a unique 10-bit instruction processor and 16-bit registers.

Ultima (Origin Systems, 1981). Richard Garriott, otherwise known as Lord British, is probably best known as the creator of this series of popular RPGs. There are nine games in the Ultima series, a total of three trilogies. The Ultima games were unique for being sold in boxes, with cloth maps and other objects meant to represent in-game elements.

Microsoft Flight Simulator 1.0 (Microsoft, 1982). Even in 1982, Microsoft understood the significance of having exclusive games on its platform. Bruce Artwick's Flight Simulator started out as a multiplatform title, but Microsoft's Alan M. Boyd signed a deal with Artwick to keep the game on Microsoft-based IBM compatibles. The game was meant to show how superior the 16-bit IBM compatibles were to existing 8-bit computers like the Apple II. Around this time, Atari was beginning to lose money, despite owning 80% of the market.

M.U.L.E. (Ozark Softscape, 1983). The titular acronym stands for Multiple Use Labor Element, which refers to a robotic beast of burden designed to aid the player (one of four) in the settling of a distant planet. M.U.L.E. was remarkable for being one of the first multiplayer computer games.

One-On-One: Dr. J vs. Larry Bird (Electronic Arts, 1983). In this licensed sports title, the first of its kind, players controlled Julius Erving or Larry Bird in a heated game of, you guessed it, one-on-one. Shattering the backboard was cool even then. And so begins the long-running tradition of Electronic Arts licensing sports figures and franchises.

Elite (Acornsoft, 1984). David Braben and Ian Bell's space trading and combat simulator was one of the first PC games to be rendered using wire-frame 3D graphics with hidden line removal. Although primitive by today's standards, the rendering technique let the ship models appear to have depth. The game was also innovative for its use of procedurally-generated worlds, of which there were 256 to explore. Elite came out after the crash of 1983, when the games industry went from being worth more than $6 billion in 1981 to being worth less than $800 million in 1984.

Where in the World Is Carmen Sandiego? (Broderbund, 1985). Easily the most popular edutainment game to come along since Oregon Trail, Where In The World Is Carmen Sandiego? used an almanac both as a learning aid and copy protection. (In order to progress, players would occasionally be asked to consult the almanac for the answers to geography questions.) This game also came out the same year that Nintendo released its Nintendo Entertainment System.

F-15 Strike Eagle (MicroProse, 1985). This game was one of the earliest combat flight simulators, and a hugely popular one at that. It sold 1.5 million copies, thanks in no small part to Sid Meier's contributions.

Maniac Mansion (Lucasfilm Games, 1987). This game, by Ron Gilbert and Gary Winnick, was the first to take advantage of LucasArts' SCUMM (Script Creation Utility for Maniac Mansion) engine, which helped the game creators avoid writing code for every location, item, and dialogue sequence they needed to create. Maniac Mansion was also notable for being a mouse-based adventure game. The VGA standard also made its debut this year, which gave IBM compatibles a major graphical upgrade.

Sid Meier's Pirates! (MicroProse, 1987). In this game, the player takes the role of a pirate, a privateer, or a pirate hunter in the Spanish Main in the 16th, 17th, and 18th centuries. The game was notable for being open-ended and player-directed, and it would serve as inspiration for Meier's later Civilization and Railroad Tycoon and Will Wright's SimCity and The Sims.

Prince of Persia (Broderbund, 1989). Jordan Mechner animated the characters in the game using rotoscoping, a technique that involves tracing over video footage to achieve realistic movements. Mechner used film of his younger brother to perfect the prince's running, jumping, and sword-fighting animations.

SimCity (Maxis, 1989). Will Wright's city-building game became the best-selling line of computer games until he managed to top that success with The Sims, which went on to become the best-selling PC game and PC game series of all time. At about the same time, the 16-bit Sega Genesis is released. Nintendo stays with 8-bit by launching the Game Boy.

Commander Keen (id Software, 1990). Although not nearly as popular as its later games, id's Commander Keen brought smooth 2D side-scrolling gaming to the PC thanks to the programming genius of John Carmack. The technology was originally demonstrated as a clone of Super Mario Brothers 3, but when approached with the demo and a pitch to enter the PC market, Nintendo declined. Commander Keen was the game that id released using Carmack's technology.

Sid Meier's Civilization became a template for future turn-based strategy games.

Going Once, Going Twice, Sold!

As we went to press, there were a total of six functional 1976 Apple I computers in existence. In November of 2012, Auction Team Breker of Cologne, Germany, sold one of the fabled six for a jaw-dropping $64,000. By the time you read this, the firm will have held another auction attempting to sell another of the functioning Apple I computers. Also on the auction block are a 1971 Busicom-141PF system outfitted with an Intel 4004 microprocessor and a genuine Altair 8800.

The Secret of Monkey Island (Lucasfilm Games, 1990). Ron Gilbert, Dave Grossman, and Tim Schafer's humorous writing made this game about the exploits of the wannabe pirate Guybrush Threepwood a favorite among fans of point-and-click adventures. The game also holds the Guinness World Record for being the first graphics adventure to become a stage play.

Wing Commander (Origin Systems, 1990). This space combat simulator popularized the idea of interactive cinema as a game. The game also had two endings; players achieved the better ending by performing well in the cockpit.

Catacomb 3-D (id Software, 1991). Although it's the third game in the Catacombs series, Catacombs 3-D was the first that is rendered in full 3D. The game introduced the long-running FPS tradition of showing the player's hand at the bottom of the screen. It used a tweaked version of the Hovertank 3D engine, which would later be used in id's Wolfenstein 3D. In 1991, Nintendo launches the Super NES, and Street Fighter II hits the arcades.

Sid Meier's Civilization (MicroProse, 1991). With Pirates! already under his belt, Sid Meier went on to perfect his strategy game formula with Civilization.

This 4X-based game (eXplore, eXpand, eXploit, and eXterminate) became the template for future turn-based and real-time strategy games, such as Master of Magic (MicroProse, 1994) and the Civilization sequels.

SkiFree (Microsoft, 1991). Chris Pirih's downhill skiing simulator isn't notable for being particularly groundbreaking, but as one of the games that was included in the Microsoft Entertainment Pack 3, it stood apart from Minesweeper and the various card and board-game translations that dominated the software bundles. Verbatim also included SkiFree in its 3.5-inch floppy GameSampler, bundled with 10-packs of blank floppies in the early'90s.

Dune II (Westwood Studios, 1992). Building upon Sid Meier's formula and a handful of real-time strategy games that came before it, Dune II was a breakout title for the RTS genre. Future games such as Command & Conquer (Westwood Studios, 1995) and Age of Empires (Ensemble Studios, 1997) would later build upon Dune II's legacy.

Wolfenstein 3D (id Software, 1992). Further refining its 3D technology, id Software's Wolfenstein 3D is notable for pushing the technology envelope. The initial plan was to develop the game on the same 16-color EGA graphics palette that was used for Hovertank 3D and Catacomb 3-D. id's Scott Miller convinced the development team to move to 256-color VGA graphics. The game also supported PC speaker, AdLib, Disney Sound Source, and Sound Blaster sound effects, as well as Adlib and Sound Blaster for music. It was also id's first game to use digital sound. 1992 was also the year that Mortal Kombat hit the arcades and the media began to focus on violence in videogames.

Ultima Underworld: The Stygian Abyss (Blue Sky Productions, 1992). Although it came out after Wolfenstein 3D, an early demo for the first-person 3D RPG Ultima Underworld used a unique texture mapping technique that inspired id Software's John Carmack. The game was remarkable for finally emerging out of development hell thanks to the late addition of Warren Spector as producer; it went on to sell 500,000 copies. Ultima Underworld was also genre-defining, laying the groundwork for games such as System Shock (Looking Glass Studios, 1994), BioShock (Irrational Games, 2007), The Elder Scrolls Series (Bethesda Softworks), Deus Ex (Ion Storm, 2000), Gears Of War (Epic Games, 2006), and Half-Life 2 (Valve, 2004).

Maniac Mansion was largely responsible for bringing mouse interaction to text and graphical adventure games.

A rubber chicken with a pulley in the middle...

The Secret of Monkey Island is still considered one of the best comedic games of all time.

Doom (id Software, 1993). You may argue that id Software occupies too much space in this article, but one thing you can't argue is that Doom was the pinnacle of the FPS genre when it came out. Doom remained a shining example of the audio-visual experience games could provide for years to come. Innovations include height differences between rooms, non-perpendicular walls, texture mapping on all surfaces (not just walls as in Wolfenstein 3D), varying lighting levels, custom palettes, and most importantly, the deathmatch model of online multiplayer gaming.

The game was immensely popular, and organizations including Intel, Lotus Development, and Carnegie Mellon University all created networking policies that banned Doom from being played due to its drain on resources. Doom also fueled the mod community, which produced thousands of new levels for the game and its sequel; the game has also been ported to just about every mobile platform. "Can it run Doom?" became the criteria by which some enthusiasts determined whether or not a given platform was worth their attention. Even the term "first-person shooter" was, albeit temporarily, replaced with the term "Doom clone."

As the new poster child for videogame violence in its extreme, the press singled out Doom as a source of inspiration for the Columbine High School shootings. This is the same year that Intel launched its Pentium processor and Panasonic ships the 32-bit 3DO console, which never managed to get off the ground.

Myst (Cyan, 1993). Despite being in the first-person perspective, Myst was the polar opposite of Doom. It was a graphical adventure puzzle-solving game that encouraged players to explore the island of Myst for clues to its origin and the player character's backstory. There was no violence, no threat of death, and no time limit. Players "win" the game by being patient, watchful, and logical. Myst, together with The 7th Guest (Trilobyte, 1993), helped spur the sales of the new CD-ROM drives in PCs.

Quake (id Software, 1996). Following the Doom series, id Software's next major franchise, Quake became the first fully 3D FPS, allowing players to look up and down and move in any direction. As a result, the FPS genre gained the z-axis and a new freedom of movement. Quake also gave Internet-based multiplayer a significant upgrade. Modders took to Quake as readily as they did to Doom and its sequels. Team Fortress and capture the flag game types can trace their roots back to Quake, as can the competitive gaming staple Unreal Tournament (Epic Games, 1999).

Fallout (Interplay Entertainment, 1997). This game, designed by Tim Cain, is an action RPG with turn-based combat. The plot revolves around the vault dweller who emerges from the vault into a post-apocalyptic wasteland. In order to secure a safe water supply for other vault inhabitants, the player must explore the world, meet with NPCs, trade, fight, and forge alliances. Fallout was unique for its '50s and '60s pop science-fiction version of the future. Fallout was also popular for its pop-culture references to Doctor Who, Mad Max, Elvis, Blade Runner, and more.

Ultima Online (Origin Systems, 1997). This game is set in the Ultima universe but takes the fantasy RPG into the persistent realm of the Internet. It is responsible for defining the MMORPG (massively multiplayer online role-playing game) and setting the stage for future MMORPGs to follow, including EverQuest (Sony Online Entertainment, 1999) and World of Warcraft (Blizzard, 2004). At about the same time, the 200MHz Pentium II was considered a must-have processor for PC gamers. Game developers were also beginning to standardize on 3D-FX graphics adapters, such as the Voodoo.

Half-Life (Valve, 1998). This series introduces gamers to the silent warrior-scientist Gordon Freeman, who's tasked with escaping the Black Mesa research facility following a teleportation experiment gone awry. Half-Life was built using a modified Quake engine, and was one of the best-selling games of all time, reaching 9.3 million unit sales by late 2008. The follow up Half-Life 2 (Valve, 2004) was also wildly popular, and the series has sold in excess of 20 million copies worldwide. Half-life mods were very popular, too. Most notably, Garry's Mod (Facepunch Studios, 2004) was released as a standalone physics and movie-making game that used the settings and assets from Half-Life and other Source Engine-based games.

StarCraft (Blizzard, 1998). The space-themed StarCraft is a science-fiction RTS that lets players take on the role of one of three species, Terran (humans), Zerg, and Protoss. The goal of the game is to harvest resources, build defenses, and then attack and destroy the enemy. StarCraft is notable for allowing up to eight players battle in the same map at once using Blizzard's Battle.net service. In 1998, StarCraft was the best-selling PC game of the year. Although it didn't add much to the genre, it became the pinnacle of what a well-balanced RTS could achieve and helped spawn the lucrative eSports movement. Blizzard has since launched an expansion (Brood War) and a sequel, StarCraft II: Wings of Liberty, and the Heart of the Swarm expansion for the sequel. The StarCraft community is still alive and well to this day.

Doom's status as one of the most influential games of all time is virtually undisputed.

Half-Life's protagonist wields his iconic crowbar for the early chapters of the game.

Counter-Strike (Valve, 2000). The Counter-Strike series started out as a Half-Life mod created by Minh Le and Jess Cliffe. The two released a beta of the game, and it quickly became popular among shooter fans. As work continued, Half-Life's developer, Valve, stepped in and began helping the pair develop the game. Le and Cliffe were hired on, and Valve bought the rights to Counter-Strike in 2000. In 2004, Valve refreshed the Counter-Strike engine by porting it to the Source engine. In 2011, Valve redesigned CS and launched it as Counter-Strike: Global Offensive on PC, MacOS X, and consoles. At the same time, Ion Storm's Deus Ex debuts, Diablo II drops some major loot for Blizzard by selling 1 million units in one week.

In 2001, Nintendo launched its GameCube, and Microsoft launched its Xbox; the PlayStation 2 came out a year before. Games were still launching for the N64, and the Game Boy Advance was the popular handheld at the time. This period marks a decline in the PC games releases, with most major games appearing on the platform as ports of console games.

Second Life (Linden Research, 2003). Launching amid a dearth of PC-exclusive games, Second Life was notable for being an MMORPG aimed at players 16 years old and older. The game is a 3D virtual world that lets players create their own objects and interact with others, but it abandoned its task-completion aspects early in its development, leading many to question whether Second Life can be classified as a game.

Defense of the Ancients (2003). StarCraft had developed a healthy modding community; one of the sci-fi RTS' most popular mods was called Aeon of Strife, which pitted two teams of five players against one another. Each team spends the early portion of the game grinding levels and building up their defenses until the later-game attack phase begins. The object is to destroy the enemy and take over their base. A mod for Warcraft III (Blizzard, 2002), called Defense of the Ancients, further refined the formula and went on to become more popular than its parent game. Valve, after securing the rights to the IP from Blizzard, is currently retooling the game type for its standalone sequel to the mod, DOTA 2. Players are already flocking to the free-to-play game in droves.

World of Warcraft (Blizzard, 2004). Shortly after it launched, WoW became the genre-defining MMORPG, and its number of subscribers has yet to be eclipsed. It spawned multiple expansions, including The Burning Crusade (2007), Wrath of the Lich King (2008), Cataclysm (2010), and Mists of Pandaria (2012). As of March, WoW had over 8 million subscribers.

In 2005, Microsoft's Xbox 360 launched, and a year later the Sony PlayStation 3 and Nintendo Wii rounded out the seventh console generation.

The PC was the ideal platform that allowed Minecraft to grow into the international phenomenon it is today.

Crysis (Crytek, 2007). From the developers of Far Cry, this game took the open-world FPS formula and put it in a sci-fi setting. The game was one of the most visually impressive games at the time, but it had stiff hardware requirements for any gamer who wanted to play it with all the settings turned up. The recommended parts include a 2.2GHz Intel Core 2 Duo or AMD Athlon 64 X2 4400+, 2GB of RAM, and an NVIDIA GeForce GTX 8800 GTS-class graphics card or better. According to NVIDIA's Roy Taylor, Crysis features more than a million lines of code, a gigabyte of texture data, and 85,000 shaders. Many websites and publications (including ours) used Crysis to test enthusiast gaming components and systems due to the game's unusually high demand for system resources.

Minecraft (Mojang, 2009). An indie Swedish programmer named Markus "Notch" Persson created an open-world exploration and building simulator with a boxy poxel (polygon-based voxel) graphic style. The worlds are procedurally generated and populated with enemies, NPCs, and a wide range of RPG elements through the game's various updates. The final version of the game, or Minecraft 1.0, came out in 2011. Notch was inspired by earlier games including Dwarf Fortress (Tarn Adams, 2006), Dungeon Keeper (Bullfrog Productions, 1997), and Infiniminer (Zachtronics Industries, 2009). As of April, Minecraft sales had crossed the 10 million mark for the PC version alone; another 10 million units have sold on other platforms, making Minecraft one of the most popular games of all time.

PC Gaming Lives

There are dozens of other titles we didn't mention that have had a hand in sculpting the PC into the most versatile gaming platform currently available. Even so, these few are more than sufficient to prove that the PC was, is, and will continue to be a driving force in the world of gaming for a long time to come. No, as a compelling gaming platform, the PC is not dead. It has GodMode enabled, infinite ammo, and unlimited lives. Gaming on the PC has a bright future indeed. ■

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06.07-09.13

GNWLAN: LANapalooza
Vancouver, WA
gnwlan.com

06.14-15.13

Fort LAN - Fort Wayne, IN
www.fortlan.org

06.14.13

Video Game Fanfest - Alexandria, VA
www.videogamefanfest.com

06.15.13

neXus LAN 4 - Ballston Spa, NY
nexusg.org/nexus

NGC's LAN-A-GEDDON
Greenville, TX
www.networkgamingclub.com

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

WV Gamers - Eugene, OR
www.wvgamers.com

06.22.13

Naois Gaming - York, PA
www.naoisgaming.com

MeltDown 2013 - Redding, CA
2013meltdown-cpu.eventbrite.com

06.27.13

LAN In The Highlands - Laughlintown, PA
www.clubconflict.com

07.12-15.13

PDXLAN 22 - Portland, OR*
www.pdxlan.net

07.12-14.13

LANcouver 2013
NCIX Warehouse, Richmond, BC
www.lancouver.com

LANFest MLP'013 Summer*
Hamburg, NY
lanfest.intel.com

07.12.13

SWVA Gaming: PnP.3
Lebanon, VA
www.swvagaming.com

07.19-21.13

LANFest Atlanta Summer 2013*
Atlanta, GA
lanfest.intel.com

07.20.13

NGC's LAN-A-GEDDON
Greenville, TX
www.networkgamingclub.com

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

08.01-04.13

QuakeCon 2013 - Dallas, TX*
www.quakecon.org

08.10.13

WV Gamers - Eugene, OR
www.wvgamers.com

08.17.13

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

Across The Nation—& Beyond!

* Event scheduled to include a *CPU* case mod contest.

NGC's LAN-A-GEDDON
Greenville, TX
www.networkgamingclub.com
AWOL LAN 22 - Eau Claire, WI
www.awollan.com

08.23-24.13

LANFest FITES* - Mechanicsburg, PA
lanfest.intel.com

09.06-08.13

Exile LAN XIII - Troy, NY
exilelan.com

09.06.13

Maryland LAN Gamers - Maryland
www.marylandlangamers.net

09.07.13

LAN OC V13.0 - Ohio City, OH
lanoc.org

09.14.13

SWVA Gaming: VII - Lebanon, VA
www.swvagaming.com

09.21.13

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org
WV Gamers - Eugene, OR
www.wvgamers.com
NGC's LAN-A-GEDDON
Greenville, TX
www.networkgamingclub.com

09.27-29.13

GNWLAN 10 - Vancouver, WA
gnwlan.com

10.18-20.13

Naois Gaming - York, PA
www.naoisgaming.com

10.19.13

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org
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NGC's LAN-A-GEDDON - Greenville, TX
www.networkgamingclub.com

11.09.13

WV Gamers - Eugene, OR
www.wvgamers.com

11.15.13

SWVA Gaming: PnP.4 - Lebanon, VA
www.swvagaming.com

11.16.13

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11.29.13

Maryland LAN Gamers - Maryland
www.marylandlangamers.net

12.21.13

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Q&A With Andy Tung

MSI's VP of Sales Talks About His Company's GAMING Series Motherboards

Q You recently launched a new Z87 GAMING series motherboard. How long has the GAMING series been around, and what other products does it include?

AT In April 2013, we implemented the first GAMING series motherboards for the Intel Z77 platform: Z77A-GD65 GAMING, Z77A-GD45 GAMING, and Z77A-G43 GAMING. These three models are MSI's first GAMING series motherboards. We also have other product lines in the GAMING series, including integrated graphics cards, gaming laptops, and all-in-one PCs.

Q What is the design philosophy behind your GAMING series, and what differentiates them from the average board?

AT GAMING series boards are built to optimize the gaming experience. We implemented Qualcomm Killer's E2200 networking chip, which can prioritize game and video streaming traffic to ensure fluidity of both network streams. This was always an issue on any non-Killer-equipped systems. Our GAMING series also implemented Sound Blaster Cinema to improve the sound experience while playing games.

Q As you mentioned a moment ago, MSI's Z77 GAMING series boards came in three configurations. Will the Z87 GAMING series boards have similar counterparts, and if so, how do the three models differ?

AT Yes, currently MSI has implemented the GAMING series into two configurations for Z87 chipset. The two models are the Z87-GD65 GAMING and Z87-G45 GAMING. The major differences between the two models are the numbers of SATA 3.0 ports each has and that the Z87-GD65 GAMING has the one-touch OC Genie feature.

Q Does the OC GENIE II button really let users overclock their GAMING series boards in one second? How does that work?

AT Yes, the user can just press the OC GENIE button or enable this feature in the UEFI BIOS and/or Windows. Once enabled, the system will be overclocked automatically after booting. MSI designed a switch with two modes for users to get higher performance. OC mode can take your PC from a 3.5GHz default to 4GHz overclock, while the Gaming mode can overclock to 4.2GHz when using the new Intel Core i7-4770K CPU.

Q What are the benefits of the GAMING Series boards' Sound Blaster Cinema audio?

AT Sound Blaster Cinema can make the surround sound in the game crystal clear and enhance some gaming sound effects.

Q Is there anything else about the Z87-GD65 GAMING that you'd like users to be aware of?

AT It supports the fastest memory available (DDR3-3000), and it comes with a completely customizable fan controller with all 4-pin PWM fan connectors. Also, it features MSI's Military Class 4 construction, the new standard in stability, built on a proven technology of high-quality components. Last but not least, I should point out that Super RAID, the definitive notebook storage technology, is now available on all our GAMING motherboards.

Q Can readers expect more GAMING Series products moving forward, and if so, can you talk about what kinds of things readers should keep an eye out for?

AT We are looking for ways to expand our GAMING series products into different product segments in the future, including possibly the microATX and Mini-ITX form factors. ■

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